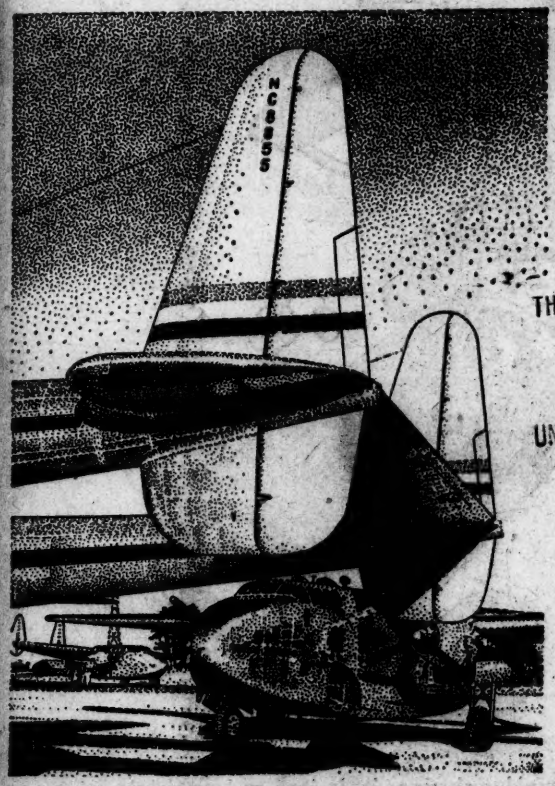
Metals Review

VOLUME XX •• No. 8 AUGUST 1947

INDUSTRIAL APPLICATIONS AND DESIGN



NOTABLE LECTURES

Reported This Month

J. H. Meier shows how performance characteristics in heavy machines, many of which can be assembled and tested only in the field, are practically determined by use of strain gages and other stress analysis methods . . . Harry McQuaid defines relationship of the metallurgist to management, production and engineering, and outlines his responsibilities in avoiding "locked-in" stresses that occur in fabrication processes . . . O. J. Horger tells how improved design, combined with modern processing methods, is increasing speed and payload of railroad rolling stock.

Featuring

Design Progress in 1946

By F. B. Dahle

Supervisor, Div. of Production Research
Battelle Memorial Institute

A comprehensive survey of recent technical literature reflecting metallurgical aspects of design problems. Based on the Review of Current Metal Literature.

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Metals Review

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RAY T. BAYLESS, Publishing Director **MARJORIE R. HYSLOP, Editor** **GEORGE H. LOUGHNER, Production Manager**

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THE ARNOLD ENGINEERING COMPANY

Design Progress in 1946

By F. B. Dahle

Supervisor, Division of Production Research

Battelle Memorial Institute

PRECEDING articles in this series describing developments in specific branches of the metal industry have had more or less definite technical boundaries. Design, however, cannot be so confined because its function is the utilization of factual data developed in *all* the basic sciences. In a somewhat broader sense, design may be considered as the engineering step between the test tube and practical application. If we accept such a definition for design, its scope is limitless.

A definite trend toward replacing the art of the craftsman with automatic precision machinery has appeared during the last quarter century. The use of automatic machinery has demanded the development of improved and more uniform raw materials. Also, along with the development of automatic machines, younger men have shown less inclination to become skilled in the various craftsman arts.

The design engineer has played the important role in hastening the transformation of art into science. This transformation was strikingly emphasized in the November 1946 issue of *Fortune*. Describing the future modern automatic factory, the article states that, although the automatic factory does not yet exist, all the necessary parts have been designed and are ready and waiting. This seems to be a rather optimistic statement because it fails to take into consideration the necessity for completely uniform properties of the raw material to be fabricated. Although tremendous strides have been made toward improving the quality and uniformity of steel, for instance, there is still much to be accomplished before it is sufficiently uniform for an automatic factory.

Aviation

The great majority of wartime design developments in the aviation industry were concerned with improvements in the jet plane. These design problems are introduced usually by pointing out the limitations in the conventional engines.

A complete engineering study of jet power plant principles, as embodied in a Messerschmitt jet fighter plane, reveals design and production compromises caused by material shortages (24-99, 1945 volume).* A number of design problems in aircraft exhaust systems have been encountered, and at the present time major effort is being directed toward the development of suitable materials for the exhaust.

Methods of testing structural aircraft assemblies to determine operating stresses for various designs include the use of Stresscoat, which is particularly valuable in the design of engine parts (24-133, Sept. 1946, and 24-58, May 1946). The use of strain gages has also expanded considerably during 1946.

Evaluation of strains in cast magnesium alloys has received considerable attention (24-86, June 1946) and in the wrought magnesium alloys it has been determined that past weight-saving studies in column design based on Euler's formula were valid only for long columns which are seldom used today (24-170, Dec. 1946).

> In conjunction with this article Mr. Dahle has prepared a bibliography of nearly 300 literature references. Many of these are primarily of a machine design or mechanical engineering nature, and space limitations prevent its publication here. However, mimeographed copies of this bibliography are available and can be obtained without charge by addressing a request to Battelle Memorial Institute, Columbus 1, Ohio.

Many wartime reports of the National Advisory Committee for Aeronautics have been declassified, and include studies of secondary stresses in open-box beams subject to torsion, and analysis of the shear lag by the principle of minimum potential energy. Shear-lag tests were also made on a box beam with a highly cambered cover in tension and with a flat cover. Stresses were determined near the junction of a closed and open torsion box as reflected by bulkhead flexibility. A comprehensive mathematical analysis of torsion in a rectangular box sheds light on stress diffusion problems (24-137, Oct. 1946). Thin-walled tubes under torsion were found to be unstable and subject to buckling by the influence of internal pressures (9-57, July 1946).

Studies have been made of bending and shear stresses developed by the arrest of the root of a moving cantilever beam. A graphical method has been developed for determining the deflexion of laterally loaded struts, as well as methods for determining the desirable lengths of Z and channel-section columns for local-instability tests. The instability of a simple pin-supported beam under local hydrostatic pressure is defined, and the problem of a beam resting on a continuous elastic foundation with concentrated elastic end supports is worked out.

The properties of columns and plate compressive strengths of extruded 24S-T and R303-T aluminum alloys and for 17S-T aluminum alloy sheet have also been developed by the National Advisory Committee for Aeronautics. Structural efficiencies of truss webs of 24S-T aluminum alloy are compared with diagonal-tension webs of 24S-T on the basis of identical allowable stresses. The critical combinations of shear and transverse direct stress for an infinitely long flat plate with edges elastically restrained against rotation are defined.

A method of calculating transverse shear strains in sandwich-type plates was developed by Chance-Vought Aircraft. Problems of transverse bending of thin plates acted on by concentrated normal forces have been solved by another new method, and a rigorous mathematical basis is used for solving problems of elastic stability of flanged plate (24-88, July 1946). A study has been made of the compressive strength of flat panels with Z and hat-section stiffeners, and conditions are defined for the influence of several factors on buckling loads of curved thin aluminum alloys sheets for monocoque constructions (24-89, July 1946). Other N. A. C. A. reports establish the effect of normal pressure on the critical compressive and shear stress of curved sheets, and recount a preliminary investigation on the relation of the compressive strength of sheet-stiffener panels to the diameter of the rivet used for attaching the stiffeners to the sheet.

The effect of cutouts and other openings in structural members is shown by data on the effect of single and multiple holes of various sizes in plates, bars, and extruded members. Spar cap configurations were investigated for the effects of stress concentration caused by large bolt holes in 14S-T

*Literature references are designated by the corresponding section and item numbers in the "Review of Current Metal Literature" rather than by repeating the entire title, author, and source. Articles appearing in 1946 and 1947 were listed in *Metals Review* for the month indicated; the others are given in volume II, 1945, assembled from listings of that year.

and 75S-T spar caps (3-167, Oct. 1946). Maximum stresses around a small rectangular cutout in a sheet-stringer panel in shear have been estimated. Tests on the shear strength of skin-stiffener panels with inspection cutouts indicate that the stress concentration existing at low stresses tends to disappear at very high stresses. Methods are proposed for supporting single thickness specimens in a fixture for the determination of compressive stress-strain curves. Stress distributions around a circular hole in an infinite aeolotropic plate subjected to tension in one direction were found for a plate with two directions of symmetry at right angles to one another.

Multiple tests were made and empirical formulas deduced to determine the crushing strength of thin steel webs. A mathematical treatment is offered for an analogy between multiple connected slices and slabs, and an empirical formula is proposed for expressing critical shear values. Flight tests show the strength required at different wing stations of a square-tipped wing in order to avoid critical failures should design limit accelerations be exceeded in flight.

Some design problems on crankshafts have been solved by laboratory stress measurements (24-105, 1945 volume). German aircraft hydraulic systems and their components have been thoroughly evaluated in comparison to our systems. An exhaust pump for aircraft engine cooling has been developed.

Design has been instrumental in reducing plane production costs. Simplification of methods has reduced tooling costs from $1,750,000 to $400,000 (24-61, May 1946). Details of design and tooling for the Ryan Fireball Fighter are described with special reference to the fabrication of light metal parts (24-44, April 1946).

Automotive Equipment

The theory of automotive design is expounded in a description of the Budd machine for testing complete car structures (24-67, May 1946). Slight variations in the design of steel cross sills and mountings for modern steel body structures will retard or improve the relative efficiency of the structure. Ride and vibration tests have been made, particularly as affected by suspension problems and vibration systems. Torsilastic or rubber torsion springs for automobiles are recommended on the basis of fundamental design advantages. This type of spring performs its own locating function without the added cost and weight of bearings and bearing seals. Furthermore, they eliminate many squeaks and rattles prevalent in conventional designs.

A novel exhaust valve of a two-piece forged and flash-welded construction has been suggested (24-111, 1945 volume). An electrical analyzer has been used to solve crankshaft torsional vibration problems for in-line engines.

A new all-aluminum refrigerated semi-trailer shows 51% less dead weight than the conventional steel trailer (23-284, 1945 volume), and a unique torsion bar suspension system on a tandem axle trailer is also described.

Railroads and Equipment

Probably the major changes in passenger car designs will involve interior decoration and equipment designed for maximum public appeal. Some improvements in trucks and other structural details are also predicted. Modification in wheel design should eliminate the impact effect of flat spots on wheels (23-244, Oct. 1946). An analysis has been made of the internal expanding locomotive type of brake design.

Suppliers of railroad equipment recently completed a continuous rotary-hearth furnace, gas fired for controlled cooling of forgings, and an axle straightener of novel design (25-104, Nov. 1946). In the calculation of the maximum stress in the web of a rail due to eccentric vertical loads, Stresscoat was used to determine the location of the maximum stress, and wire resistance strain gages for the magnitude of the stress (24-181, Dec. 1946).

Aids to Machine Design

Among methods for improving drawings, templets, patterns, and models is the "Leete" system of isometric drawing. From an economic manufacturing and assembly standpoint, unnecessarily small tolerances should not be specified on engineering drawings (24-80, June 1946). Closer cooperation between the designer and the fabricator is emphasized, as well as proper dimensioning of die-cast parts drawings (24-100, Aug. 1946).

A survey of phototemplet methods was made in the Southern California airplane industry (24-51, April 1946). Layout production by the "Loftec" method uses master negative units made of metal coated with luminous paint (24-104, 1945 volume). In discussing the accurate placement of templets, Dickason considers the neutral line, stresses during bending, bends in duralumin, and duralumin end support brackets (24-140, Oct. 1946). Convair's new three-dimensional positioners simplify and speed up the work in assembly tooling (24-102, 1945 volume). A new method is described for the development of patterns for irregular bodies of unequal taper (24-122, Sept. 1946) and two general methods of dimensioning parts for machining and casting uses are compared (24-81, June 1946).

Stresses and Strains

A mechanical equation of state theory suggests that the stress required for flow depends upon instantaneous values of strain, strain rate, and temperature and not upon their past values (3-187, Nov. 1946). Methods for measuring stress and strain in solids are reviewed (24-193, Dec. 1946), and Poisson's ratio values for some structural alloys subjected to large strains have been calculated (24-187, Dec. 1946). Stress analysis in the early stages of product design will often result in reduction of material and processing costs and in better parts (24-75, June 1946).

Stress gages simplify analysis because they aid in solving biaxial stress equations without second measurement or calculation (24-106, Aug. 1946). A numerical procedure has been applied to stress analysis of stringer-reinforced panels, and fundamental theorems have been developed for calculating stresses in frames by analysis and experiment. Mathematical analysis of stress diffusion has also been applied to reinforced panel design (24-137, Oct. 1946). Industrial applications of X-ray stress analysis are described by McCutcheon (24-85, June 1946). The criterion of making units of structural "tessellation" self-compensated is the equality of the shear moduli of elasticity of the components (24-92, July 1946). Impact stress in elastic bodies can be calculated by the energy method (9-28, April 1946). The sum and difference method is used for calculating stresses in disks, and a superposition method for calculating the stresses in turbine wheels.

The effects of tension on the magnetic properties of 68 Permalloy, nickel, and iron have been studied. Stress comparisons were made by correlation with high-frequency magnetic and eddy current losses (12-230, 1945 volume). The pulling force and stress distribution in the drawing of wires has been calculated (24-57, April 1946). A discussion of yield point in bend tests deals mainly with the difficulties of detecting the load at which yielding started in the most stressed fiber (24-175, Nov. 1946). Straub proposes that fatigue failure may be caused by compression rather than by tension stress, as in the operation of bending (24-186, Dec. 1946).

A method is described for determining the shape of a crack resulting from the application of a variable internal pressure to a very thin crevice in the interior of an elastic solid (24-160, Nov. 1946). Charts have been compiled showing the maximum allowable working stresses for steels ranging in hardness from Brinell 160 to 555 (24-53, April 1946). Stresses have been calculated for a solid glass cylinder sealed to the inside of a metal cylinder (24-154, Oct. 1946).

Basic elongation data can be used in conjunction with a geometrical analysis to expedite the determinations of formability limits of a part. The photo grid method is being used for strain analysis (24-155, Oct. 1946), and a recent method permits the graphical evaluation of principal strains from strains measured along any three intersecting lines (24-177, Nov. 1946). Investigations report measurements of constant true strain rates in tension tests (9-150, 1945 volume, and 9-127,

Nov. 1946). In engine design it is important to proportion parts so as to take advantage of beneficial prestress (24-150, Oct. 1946). Resistance of metals to cyclic stresses can be measured by standardized laboratory methods and certain procedures are then available to the designer and production engineer to minimize the occurrence of fatigue failures (9-45, June 1946). An equation of elastic resilience has been developed by a mathematical treatment of the geometry of strain (24-194, Dec. 1946).

Design Considerations in Processing Methods

As the prime causes for intergranular fracture in cast steel Lorig cites aluminum nitride precipitation at grain boundaries and ferrite precipitation as a network on the primary grain boundaries (3-155, Sept. 1946). X-ray examination of quenched and tempered metal samples shows that martensite changes on tempering into ferrite and cementite (4-71, Oct. 1946). According to Herzig, until fundamental work provides more knowledge of the elastic behavior of cast iron, a relative modulus of elasticity should be calculated from transverse tests using present empirical assumptions (9-39, June 1946).

Cemented carbides offer the designer a variety of grades, specified shapes formed to close tolerance, approach to the diamond in hardness, high compressive strength and good corrosion resistance (5-39, July 1946). Design of powder metal parts has been discussed in detail and powder metallurgy compared with other competitive processes (5-34 and 5-36, July 1946; and 5-66, 1945 volume).*

Casting, Forging and Stamping

Designing for precision casting follows simple rules (24-105, Aug. 1946). Mechanical properties should be considered in die-casting design, with reference to static bending stresses (24-99, Aug. 1946). Location of the flash is important (24-1, Feb. 1946), and stressed members should be analyzed with a view to weight reduction and elimination of structural failures (24-83, June 1946). Designs are described for torsional members subjected to static loads (24-162, Nov. 1946). Methods for calculating the weight of die castings from the original blueprint rely upon determination of the volumes of component forms (24-146, Oct. 1946, and 24-192, Dec. 1946). Use of die castings in a power lawn mower has certain advantages, particularly ease of assembly, reduced machining, and reduced weight (24-15, Feb. 1946).

Methods of fabrication and tolerances as they affect design of forgings are described for extrusion forgings, impression die forgings, and coin forgings (24-114, 1945 volume). Abnormally high forging and machining costs can be avoided through the utilization of an "upright helve hammer". This is a progressive forging operation (24-47, April 1946). Drop forging design is discussed with reference to the machine and the flow lines in the forging (24-25, March 1946).

Problems of engineering design are a specialty of F. B. Dahle, who heads the division of production research at Battelle Institute. He is especially conversant with metallurgical engineering, in which he received his academic training and much of his professional experience. Mr. Dahle joined the research staff of Battelle Institute after graduation from the University of Minnesota in 1930. In 1944, when the production research activities of the Institute were centralized into a separate division, he was named head of that division. Mr. Dahle is the author of numerous publications on the engineering properties of materials.

John Mueller has written a series of articles discussing the forging of motor crankshafts from the die design standpoint (24-4, Feb. 1946), hot trimmers (24-78, June 1946) and cold trimmers (24-60, May 1946). Hydraulic presses for forging steel parts, types of forging die steels and arc welded hydraulic presses are discussed in a series of articles on designing of trouble-free dies (24-8, Feb. 1946, and 24-24, March 1946).

In the stamping and deep drawing of metal parts, the influence of production processes on design is indicated in such processes as shallow drawing, forming, punching, blanking, piercing and perforating (24-119, 1945 volume). The same line of thought is carried out by Mills to show how different methods of manufacturing affect production design (24-103 and 24-115, 1945 volume). He also gives specific data on design of dies for fabricating stock under 0.020 in. thick (24-130, Sept. 1946).

The principles governing the design of dies for press working, particularly flanging dies, are presented (24-31 and 24-34, March 1946), and a continuous series of articles describes designing of press tools (24-46, April 1946; 19-127, June 1946; 24-119, Sept. 1946). Another series on designing of trouble-free dies covers various phases of sheet metal fabrication. These include both die design and special methods for perforating, blanking, shaving, and other operations (24-48, April 1946; 24-62, May 1946; 24-115, Sept. 1946; 24-136, Oct. 1946; 24-165, Nov. 1946).

The proportions, properties, and other basic factors that must be considered to assure desired strength and stiffness in the design of magnesium castings are discussed in some detail (24-73, May 1946).

The mechanical design of gravity dies is illustrated by difficult die castings (14-253, Oct. 1946; 14-258, Nov. 1946; 14-278, Nov. 1946), and modern design tendencies are revealed for both casting and welding (24-113, Sept. 1946.)

Tools and Fixtures

Modern methods in tool design are described for the following operations: forming an irregular shaped spring, riveting grooved studs, milling T-slots with carbide-tipped cutters, drilling a bell-crank lever with a forked arm, punching holes in short tubes (24-18, Feb. 46). Lotz suggests that, in redesigning, a careful re-appraisal of materials and production processes would effect cost savings and improve machine parts (24-118, 1945 volume). Some design criteria were evaluated in the application of fabricated construction to machine design (24-20, March 1946).

Precise structural model testing is discussed with attention to the laws of similarity (24-22, March 1946). Equations are derived for determining the frequency of free vibration for combined torsion and translation of a machine supported at four corners by springs. Design of supersensitive balancing equipment is described (24-39, March 1946). The brittle lacquer method of stress analysis short-circuits much expensive and time-consuming testing in developing new and improved machine parts (24-121, 1945 volume).

Points to be considered in designing work for bending, and the features of a tangent bender for tucking flange metal are discussed (19-175, Aug. 1946; 24-117, 1945 volume). Double-action equalizers, work centralizing, and designing efficient clamps are considerations when designing milling cutters and fixtures (24-85, March 1946). Examples show how automatic broaching setups may be designed to broach complex parts (24-50, April 1946). Use of a grooving lathe to cut intermittent grooves or indentations in alloy steel rolls entails certain problems (20-122, April 1946). Design and mold assembly for an aluminum polishing head is presented (24-108, Aug. 1946), and design factors for taper and parallel-shank running centers in a variety of machine services are reviewed (24-108, 1945 volume).

An intermittent feeding mechanism operates two slides from one cam for feeding a continuous strip of corrugated flat wire stock through a fabricating machine. A new design for bobbin fingers used in textile machinery eliminates a large number of finishing operations (24-163, Nov. 1946). Methods of calculating stresses in crane hooks or similar curved bars have been devised (24-179, Nov. 1946). The design of accurate live tailstock rams and running centers is discussed with rela-

(Turn to page 9)

*Articles concerning design considerations in plastics are listed in the bibliography available from Battelle Memorial Institute.

A.S.M. Review of Current Metal Literature

An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad, Received in the Library of Battelle Memorial Institute, Columbus, Ohio, During the Past Month.

1 ORES & RAW MATERIALS Production; Beneficiation

1-70. The Treatment of Gold Ore Containing Pyrrhotite at the Sub Nigel, Ltd. Andrew King, A. Clemes and H. E. Cross. *Journal of the Chemical, Metallurgical and Mining Society*, v. 47, Feb. 1947, p. 291-297; discussion, p. 297-300.

Certain difficulties which arose in the cyanide treatment of ore; results of investigations and steps found necessary to overcome these difficulties.

1-71. Symposium on Milling Devices and Practices. J. F. Myers and R. J. Tower. *Mining Technology*, v. 11, May 1947, T. P. 2162, 15 p.

Equipment, auxiliary apparatus, and concentration practice in a variety of mills throughout the country.

1-72. Comparison of Galena and Ferrosilicon in Heavy-Media Separation. E. H. Crabtree, Jr. *Mining Technology*, v. 11, May 1947, T. P. 2181, 5 p.

Operating results and the costs of operation of the two media. Galena concentrate was used at mill of Eagle-Picher for over two years and then replaced by minus 100-mesh ferrosilicon. Results indicate superiority of the ferrosilicon.

1-73. A New Separating Vessel for Sink-Float Concentration. E. C. Bitzer. *Mining Technology*, v. 11, May 1947, T. P. 2182, 19 p.

Three years of work on both iron ore and lead-zinc ore, on both a pilot-plant and commercial scale, resulted in improvements in both mechanical and metallurgical performance, as a result of substitution of a spiral classifier for a cone in the separating circuit of the heavy-media process. Definite advantages are indicated for concentration of any material containing large amounts of solids having a specific gravity close to that of the separating medium.

1-74. Treatment of Idaho-Wyoming Vanadiferous Shales. S. F. Ravitz, I. W. Nicholson, C. J. Chindgren, L. C. Bauerle, F. P. Williams, and M. T. Martinson. *Metals Technology*, v. 14, June 1947, T. P. 2178, 14 p.

Bureau of Mines work on two different types of vanadium-containing ores. The ore from southwestern Wyoming contains about 1% V_2O_5 and 2 to 3% P_2O_5. More than 90% can be recovered by baking with strong H_2SO_4 solution followed by leaching. The ore from southeastern Idaho contains about 1% V_2O_5 and 10% P_2O_5. Processes were worked out for three variations of this ore, using roasting and leaching. Both vanadium and phosphate can be recovered.

1-75. Rock Drill Oil May Help or Hinder Your Flotation. E. C. Herkenhoff. *Engineering and Mining Journal*, v. 148, June 1947, p. 88-90.

Experimental data show that lubricants used in drilling have either an adverse or a helpful effect on flotation.

1-76. Chromium-Iron Ratio Chart. *Engineering and Mining Journal*, v. 148, June 1947, p. 108.

Chart relates percentages of FeO and Cr_2O_3 to Cr-Fe ratio.

1-77. Vital Magnesite Mined in the State of Washington. *Link-Belt News*, v. 14, June-July 1947, p. 1-3.

Ore preparation and concentration procedures. Flow sheet. Materials-handling equipment.

1-78. Beneficiation of New England Beryllium Ores. Frank D. Lamb. *Mines Magazine*, v. 37, May 1947, p. 19-22. (Reprinted from Bureau of Mines Report of Investigations 4040.)

Method adopted and results of tests on New Hampshire, Connecticut and Maine ores.

1-79. Transport and Deposition of the Nonsulphide Vein Materials. Part II. Cassiterite. F. Gordon Smith. *Economic Geology*, v. 42, May 1947, p. 251-264.

Experiments made to determine the mechanism of formation of cassiterite. This material was prepared by means of high pressure reactions using sodium stannate, alkali, sodium fluoride, and sometimes other reagents. 30 ref.

1-80. Classification at the Sullivan Concentrator. G. J. Knighton and W. Holdsworth. *Canadian Institute of Mining and Metallurgy Transactions*, v. 50, June 1947, p. 362-374. (Bound with *Canadian Mining and Metallurgical Bulletin.*)

Treats a complex lead-zinc-iron ore to make a lead and a zinc concentrate. The ore body consists typically of banded sulphides, mainly galena, sphalerite, pyrrhotite, and pyrite. Important factors in the concentration of the ore are its exceedingly complex nature and its high specific gravity.

1-81. The Production of Molybdenite and Bismuth at La Corne, Quebec. F. K. McKean. *Canadian Institute of Mining and Metallurgy Transactions*, v. 50, June 1947, p. 375-388. (Bound with *Canadian Mining and Metallurgical Bulletin.*)

A sequel to "A Process for Cleaning Molybdenite Concentrate," published in a recent issue (p. 36-48, 1947). The work of translating laboratory experience in developing a new process for treating complex molybdenite ores (described in previous paper) into mill practice; what changes were required in design to put the scheme on an operational basis, and the improvements in mill products which resulted from the new procedure.

1-82. Mesaba Range Changes Heavy-Media Practice. E. C. Bitzer. *Mining Congress Journal*, v. 33, June 1947, p. 36-39.

Recent developments make the process considerably more attractive than it was a few years ago. Limitations as well as some possibilities for extending the usefulness of the process.

1-83. On the Geochemistry of Columbium. Kalvero Rankama. *Science*, v. 106, July 4, 1947, p. 13-15.

Results of work in Finland.

For additional annotations indexed in other sections, see:

2-152; 3-167; 27-140-141.

2 SMELTING AND REFINING

2-131. Blast Furnace Practice Under High Pressure Operation. J. H. Slater. *Steel*, v. 120, June 9, 1947, p. 102-104, 106.

Necessary changes in construction and in operating methods.

2-132. Basic Steelmaking. K. Balajiva and P. Vajragupta. *Iron and Steel*, v. 20, May 23, 1947, p. 276-277.

Previous work on the effect of temperature on the phosphorus reaction at temperatures of 1585 ± 10° C. was extended to other temperatures within the range of normal basic steelmaking practice—that is from 1550 to 1635° C. Results indicated that the empirical relationship previously established between total lime content of the slag and phosphorus equilibrium constant is valid over the entire range. X-ray examination of slags obtained also confirms previous conclusions concerning constitution of basic slags.

2-133. Lithium Metal, Laboratory Preparation by Vacuum Metallurgy. W. J. Kroll and A. W. Schlechten. *Metal Industry*, v. 70, May 30, 1947, p. 395-398.

Present methods of preparing lithium. Advantages which would result from vacuum method. Thermal reduction and reducing agents. Production and reduction of lithium oxide, lithium carbonate, lithium chloride and lithium fluoride. (From a paper recently presented before the A.I.M.E.) 10 ref.

2-134. Production of Alumina by the Lime Soda Process. Part V. W. E. Prytherch, M. L. R. Harkness, and W. D. Spencer. *Chemcal Age*, v. 56, May 31, 1947, p. 717-720.

Removal of silica from alumina and its solutions. (Concluded.)

2-135. Symposium on Radiant Energy and Gaseous Reaction. Part II. *Industrial Heating*, v. 14, June 1947, p. 909-912.

Reviews paper by A. J. Fisher on relation of flame character to open-hearth operation, presented at recent American Institute of Chemical Engineers' meeting in Pittsburgh. A theoretical discussion of the various components making up total flame radiation, and a practical discussion of the need and the ways and means of controlling flame radiation in the open-hearth furnace.

2-136. Rate of Reduction of Geneva Iron Ore. John R. Lewis. *Metals Technology*, v. 14, June 1947, T.P. 2177, 15 p.

Apparatus and procedures devised for study of the above on a laboratory scale. Accurately ground cubes of iron ore were reduced in a stream of hydrogen passing through a laboratory tube furnace.

2-137. Laboratory Preparation of Lithium Metal by Vacuum Metallurgy. W. J. Kroll and A. W. Schlechten. *Metals Technology*, v. 14, June 1947, T.P. 2179, 9 p.

Lithium metal was produced readily by the reduction of Li_2O and CaO mixtures with silicon or aluminum in a vacuum of less than one micron and at temperatures of 950 to 1000° C. Magnesium-lithium alloys can be made by reducing Li_2O and CaO mixtures with magnesium at 950° C. It appears that lithium is produced more easily by vacuum methods than is magnesium, barium, calcium, or strontium. The laboratory methods described could be used with little modification for the commercial production of this metal of outstanding purity. 10 ref.

2-138. Experimental Laboratory Study on Effect of Pressure on Carbon Deposition and Rate of Reduction of Iron Oxides in the Blast Furnace Process. L. F. Marek, A. Bogrow, and G. W. King. *Metals Technology*, v. 14, June 1947, T.P. 2184, 24 p.

Data and an interpretation of the results of a laboratory study of the above. Effort was made to approximate the conditions prevailing in commercial blast furnaces.

2-139. Oxygen in Basic Electric-Furnace Baths. S. F. Urban and G. Derge. *Metals Technology*, v. 14, June 1947, T.P. 2185, 15 p.

Heat records including oxygen anal-

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...ion to the effect of continuous bending (24-106, 1945 volume).

A number of references to articles on design of hydraulic systems, gears and transmissions (in which metallurgical considerations are of relatively minor importance) are included in the bibliography available from Battelle Memorial Institute. Among these references are an account of practical considerations that affect gear durability in speed reducers (24-79, June 1946). The design of welded steel reduction gear drives is explained (24-151, Oct. 1946), and a study of helical gear action is reported (24-93, July 1946; 24-117, 24-121, and 24-126, Sept. 1946). An explanation is given of why unequal pressure angles produce balanced tooth action in hypoid gears (24-45, April 1946).

Fastening by Welding, Riveting, and Bolting

Snyder supplies some basic considerations to aid engineers in planning designs of machines and structures suitable for construction by welding (24-16, Feb. 1946), and shows the limitation of equipment and methods for dynamically loaded welded machine parts (24-13, Feb. 1946). Rules for good welding design and comparative data on strength of weld and bare metal are illustrated (24-102, Aug. 1946). Use of standard and special rolled shapes, proper shop equipment and sound design techniques achieve superior weldments at low cost (24-128, Sept. 1946). Economies resulting from butt welding techniques along with butt-flash welding machines are described (24-101, 1945 volume). The designer of welding equipment should consider available welding processes, weldability of material, types of joints, cleaning of joints, and proper sequence of operations to minimize distortion (22-421, Oct. 1946).

A new manual of design for arc welded steel structures gives fundamentals of design, a system of standardized welded details, and includes welding terms and definitions and other related data (27-94, Sept. 1946). Spot welding design data are also given (24-191, Dec. 1946).

Tensile tests have been made on conventional machine and countersunk flush rivets, and effect of variations in diameter and pitch of rivets on the compressive strength of panels has been determined. A theory of positive locking devices includes a discussion of why locknuts are needed (22-56, March 1946). Self-locking nuts are evaluated, with analyses of plain, jam, and castellated nuts, nut and lock-washer combinations, and nuts with built-in self-locking features. Some torque values for standard AN bolts and nuts are listed (24-166, Nov. 1946).

Mechanical Elements and Systems

The bibliography already mentioned contains an extensive list of references concerning design considerations for springs; seals, valves and piping; pumps and pressure vessels; exhaust systems and fans; and motors and electrical equipment. Most of these are primarily of mechanical interest, but a few of them deserve mention here.

Spring strength can be improved by the utilization of residual stresses resulting from forming operations on slot springs (24-96, July 1946). Plate springs afford many advantages when applied to fluctuating or surging loads. An analysis is provided for a flat spring initially curved and inserted in the apparatus of which it is an element in a buckled condition (24-178, Nov. 1946). A stranded wire helical spring compares favorably with conventional helical springs (24-103, Aug. 1946). The simple classical theory of vibration for a system having a single degree of freedom is applied to the isolation of vibration in spring-mounted apparatus.

The basic considerations in the design, selection and installation of various types of mechanical seals have been described. Rotating shaft seals range from simple flange packings to elaborate bellows and lapped-surface devices. Felt seals and oil seals (ring, labyrinth, and contact types) are discussed and compared.

Motorized control valves of sliding stem type are used in globe valves and in associated electric or pneumatic power units. A hydraulic change-over valve is used for rapid simultaneous switching of several fluid or gas lines. In a simplified method for accurate calculation of orifices the effect of the fundamental variables may be seen at a glance.

Stress in piping systems has been measured by an electrical robot in a laboratory model (24-43, April 1946). A method for calculation and selection of cooling coils for minor applications is presented (24-107, 1945 volume). A suitable relationship has been found from which the strength of any form of unreinforced branch pipe can be determined, and a new type of reinforcement makes the branch piece stronger than the corresponding straight pipe (24-123, Sept. 1946).

Advantages, operating and maintenance costs, pros and cons of welded and riveted construction for spherical high-pressure gas holders are discussed (23-236, Oct. 1946), and the design of gas holders of 175,000 cu.ft. capacity at 55 psi. pressure is described (24-153, Oct. 1946). A series of articles by Stebbins gives complete details for designing exhaust systems, such as plotting air currents approaching an air intake, details of dust separators and arresters, and the recirculating system. Paint spray booths, hoods, and boots are also considered (24-12, Feb. 1946; 24-118, Sept. 1946).

Resourceful motor design and ingenious modification of basic types of motors provide unusual operating characteristics for special industrial uses. Height, weight, and liquid volume of high-voltage potential transformers are radically reduced by application of a new design announced by General Electric (25-78, Sept. 1946). A plea was submitted for the standardization of electrical equipment for machine tools (24-17, Feb. 1946).

Coordination between shop and engineering department is essential once quality control is adopted. The control system can also be used in evaluating laboratory test data on preproduction models (24-82, June 1946). Designs of servomechanisms for error detecting, of computing mechanisms, of instrument-air-supply systems for process units, of the Bourdon gage, and of the vacuum switch are indicated in the bibliography. A series of papers on heat transfer published in the *Transactions* of the American Society of Mechanical Engineers is also listed.

Buildings and Structures

A new treatment for minimum design loads in buildings dependent upon live loads is based on actual loads, and inward and outward wind pressure on walls and roofs. In reinforcing bars for concrete, a length of splice 30 or more times the bar diameter is sufficient to develop the yield strength of the bar. Rules are offered which enable the engineer to select the proper size angle iron in designing structural steel frames, without reference to tables or handbooks (24-134, Sept. 1946). Suggestions to aid the designer in selecting aluminum structural sections are given (24-36, March 1946), and the ductility of light metals and alloys in comparison with other heavy structural materials has been measured under combined tension and bending stresses (24-180, Dec. 1946). The relation of stress and strain in plastic flow to steel structural parts in ships has been investigated (24-159, Oct. 1946). Shear stresses in welded plate girders are analyzed (24-145, Oct. 1946).

Miscellaneous

Among the year's new books is a practical treatise on applied elasticity (27-114, Oct. 1946). Photoelasticity was used to solve a problem involving a snap ring used to retain a shaft on a strapping tool (24-40, March 1946).

Features involved in designing gages are considered (24-26, March 1946), and basic rules and procedures to relate tolerances and gage design are surveyed (24-76, June 1946). New principles are evolved for thread ring gage design (24-142, Oct. 1946).

A wide range of designs is available to fit roller bearings to each application (24-132, Sept. 1946). A stress analysis was made of tube-sinking operations (24-172, Nov. 1946). Failures in drill pipes, it is shown, are caused by a reduction in the yield strength resulting from the alternating stresses encountered in drilling.

The design of coils for induction heating is an art that necessitates full consideration of the fundamental requirements (18-35, March 1946). New domestic ware is designed to use light alloys and to suit modern tastes and circumstances (22-19, March 1946.)

yses in addition to slag and metal analyses were assembled and examined for 30 electric-furnace steel heats. Available methods of sampling for oxygen are compared. 10 ref.

2-140. Iron and Steel Manufacture. Ralph W. Farley. *Metal Progress*, v. 51, June 1947, p. 972-975.

Reviews papers presented at Cincinnati conference of the Open Hearth, Coke Oven, Blast Furnace, and Raw Materials Committees of the American Institute of Mining and Metallurgical Engineers, April, 1947.

2-141. Oxygen Firm Outlines Its Research Program for Steelmaking Applications. *Iron Age*, v. 159, June 12, 1947, p. 109-110.

Summarizes information released by Linde Air Products Co.

2-142. Oxygen Jet Speeds Openhearth Steel Output. *Iron Age*, v. 159, June 19, 1947, p. 75-76.

Device consists of a central oxygen supply pipe surrounded by two concentric water-cooled passages. It cuts down exposed portions of scrap rapidly, producing a small amount of superheated molten scrap steel, and clears a path for the main burner flame, increasing the charge area exposed, thus improving over-all heat transfer. Thus meltdown time and decarburization time are reduced. Results are superior to those obtained with lances.

2-143. What About the Use of Oxygen in Steelmaking? John D. Knox. *Steel*, v. 120, June 23, 1947, p. 107-108, 144, 146.

Four methods employed for decreasing the melting period. Oxygen burner practice reduces charge-to-tap time from 10 to 25% and yields better control of slag temperature. Auxiliary burners promise reductions in charge melting time. Evaluation of results.

2-144. Some Factors in the Reduction of the Iron Content of Magnesium-Base Alloys. F. A. Fox, C. J. Bushrod, and S. E. Mayer. *Magnesium Review and Abstracts*, v. 6, Oct. 1946, p. 109-111. (Reprinted from *Journal of the Institute of Metals*, v. 73, no. 2, 1946.)

To be concluded.

2-145. Fundicao de Aco. (The Casting of Steel.) Ferrucio Fabriani. *Boletim da Associacao Brasileira de Metais*, v. 3, April 1947, p. 297-302.

Problems in casting steel ingots with particular attention to eliminating defects in the castings.

2-146. Um Metado Geral Para Caiculo das Cargas de Fornos de Chumbo. (A General Method of Calculating the Charges for Lead Furnaces.) Tharcisio D. de Souza Santos. *Boletim da Associacao Brasileira de Metais*, v. 3, April 1947, p. 303-318.

Charges for furnaces to reduce sintered compacts or lead ores. A method for solving the problems which arise in reducing plants.

2-147. Silicon Carbide. E. A. Loria, H. D. Shephard, and A. P. Thompson. *Iron and Steel*, v. 20, June 1947, p. 317-318, 320.

Use as a deoxidizing agent in basic electric steelmaking. (From a paper presented to the Electrochemical Society.)

2-148. Talks About Steelmaking. Harry Brearley. *British Steelmaker*, v. 13, June 1947, p. 290-293.

Segregation.

2-149. What About the Use of Oxygen in Steelmaking? John D. Knox. *Steel*, v. 120, June 30, 1947, p. 86-88, 90, 92.

Improved procedure in use of lances greatly extends life of steel pipe. Smoke elimination is achieved by various methods. Furnace performance is affected largely by purity of oxygen.

2-150. Teaching the Blast Furnace New Tricks. C. H. Vivian. *Compressed Air Magazine*, v. 52, July 1947, p. 162-166.

Republic's work on pressure-blowing.

2-151. Notes on Swedish Acid Openhearth Practice. S. M. Wejle. *Iron Age*, v. 160, July 3, 1947, p. 67-68.

Factors which help produce a superior quality steel.

2-152. Effect of Sized and Nodulized Mesaba Iron Ores on Blast Furnace Performance. Herman F. Dobscha. *Skilling's Mining Review*, v. 36, July 5, 1947, p. 1-2, 4, 6, 13.

Blast furnace tests conducted at Edgar Thomson works of Carnegie-Illinois Steel Corp. showed distinctive advantages in increasing iron production and decreasing fuel consumption when using prepared iron ores. It is believed that an ultimate production rate in excess of 1700 tons of iron per day could be maintained. The test also revealed the excellent iron-production and fuel-economy potential of large, modern blast furnaces and indicated the desirability of providing adequate blowing capacity when operating on a burden composed of prepared ores and coke made from washed coals.

For additional annotations indexed in other sections, see:
11-86; 16-89; 27-127-131.

3 PROPERTIES OF METALS AND ALLOYS

3-167. Titanium and Zirconium. W. H. Waggaman and E. A. Gee. *Federal Science Progress*, v. 1, June 1947, p. 18-19.

Properties, methods of manufacture, occurrence of raw materials, and applications.

3-168. Behavior of Metal Cavity Liners in Shaped Explosive Charges. George B. Clark and Walter H. Bruckner. *Mining Technology*, v. 11, May 1947, T.P. 2158, 12 p.

The behavior of the metal in cavity liners when they are subjected to intense pressures exerted when the explosive charge is detonated. Physical and mechanical properties of the metals were found to have a marked effect upon their performance as a cavity-liner material. Study of the microstructure of a collapsed cavity liner resulted in development of a theory explaining the phenomenon of jet-formation.

3-169. Effect of Prior Tensile Strain on Fracture. Edward Saibel. *Metals Technology*, v. 14, June 1947, T.P. 2186, 8 p.

The above effect is investigated in a theoretical manner from the point of view developed by the author in his thermodynamic theory of the fracture of metals. Results are compared with experimental findings and a rational interpretation is given to work that shows the variation of fracture stress with prior tensile strain.

3-170. The Dependence of the Magnetostriction of Nickel Upon Initial Magnetic Texture and Sequence of Applying Magnetic Field and Unidirectional Elastic Tension. J. Shur and A. Khokhlov. *Journal of Physics (U.S.S.R.)*, v. 11, no. 1, 1947, p. 77-84. (In English.)

3-171. Hardenability. *Iron and Steel*, v. 20, May 23, 1947, p. 281-286.

An extended discussion on the recent symposium. (Special Report No. 36 of the Iron and Steel Industrial Research Council.)

3-172. High Creep Strength Austenitic Gas-Turbine Forgings. D. A. Oliver and G. T. Harris. *Engineer*, v. 183, May 30, 1947, p. 468-469.

Characteristics required for gas-turbine use. The properties and chemical compositions of five British steels. Special problems in the melting, casting, forging, heat treating, machining, inspection, and testing of solid rotor forgings. (To be continued.) (Condensed from paper presented to Institute of Marine Engineers, April 1947.)

3-173. Internal Friction in Engineering Materials. Andrew Gemant. *Journal of Applied Mechanics*, v. 14 (*Transactions A.S.M.E.*, v. 69), June 1947, p. A164.

Discussion of paper by I. M. Robe... son and A. J. Yorgiadis, published ... Sept. 1946 issue and authors' reply.

3-174. Zirconium and Its Applicati... W. M. Raynor. *Mining and Metallur...* v. 28, June 1947, p. 284-285.

A brief discussion.

3-175. Wrought Aluminum Alloys. ... Chadwich. *Metal Industry*, v. 70, Ju... 6, 1947, p. 415-418.

Characteristics of commerci... wrought aluminum alloys, with t... object of giving the user of light allo... a clear picture of the choice availabl...

3-176. Characteristics of Three Hig... Temperature Alloys. J. B. Henry, ... *Iron Age*, v. 159, June 12, 1947, p. 58-...

Three special alloys, developed du... ing the war by Allegheny Ludlum, a... compared from the standpoints o... cost, physical properties, and metho... of fabrication, heat treatment, an... machining. Use of the vibration ... tuning-fork samples for modulus ... elasticity measurements.

3-177. Hardest Man-Made Materia... *American Machinist*, v. 91, June 19, 19... p. 122-124.

Characteristics and typical uses o... boron carbide.

3-178. British High Temperature Steel... for Gas Turbines. C. Cyril Hall. *Steel*, v. 120, June 23, 1947, p. 101, 132.

Properties of the alloys.

3-179. Wrought Aluminum Alloys. R... Chadwick. *Metal Industry*, v. 70, Jun... 13, 1947, p. 435-438; June 20, 1947, p. 45... 458; June 27, 1947, p. 484-486.

Characteristics and relation of prop... erties to composition and constitution. ... 27 ref.

3-180. Brittleness in Metals. Part III... *Metal Industry*, v. 70, June 13, 1947, p. ... 439.

Effect of bismuth in gold, and of ... sulphur in nickel.

3-181. Super-Conductivity. E. Schroter... *Metal Industry*, v. 70, June 13, 1947, p. ... 444-445.

A review of recent research on the ... above property of both metals and ... nonmetals in the neighborhood of ... absolute zero. (Translated and condensed from recent issue of *Zentralblatt für die Osterr Industrie und Technik*.)

3-182. Ferromagnetic Resonance at ... Microwave Frequencies. W. A. Yager ... and R. M. Bozorth. *Physical Review*, v. ... 72, July 1, 1947, p. 80-82.

Experiments designed to test Kittel's ... theory and to evaluate the gyromagnetic ratio.

3-183. Metallurgical Considerations in ... High Temperature Steam Piping Systems. J. J. Kanter. *Proceedings of the Midwest Power Conference*, v. 9, 1947, p. 236-240.

3-184. Materials as a Consideration in ... Modern Boiler Feed Pump Construction. H. L. Ross. *Proceedings of the Midwest Power Conference*, v. 9, 1947, p. 241-244.

Causes and remedies for corrosion-erosion, and properties of different metals and alloys used for boiler-feed pumps.

3-185. Boron as an Alloying Element in ... Steel. D. E. R. Hughes. *Engineering Materials*, v. 5, Feb-April 1947, p. 14-15.

A review.

3-186. Damping Capacity, Strain Hardening and Fatigue. R. F. Hanstock. *Proceedings of the Physical Society*, v. 59, March 1, 1947, p. 275-287.

An electromagnetic method for exciting torsional resonance vibrations. For some alloys of aluminum, notably binary alloys containing 5% and 11% of magnesium, vibrational strains of sufficient magnitude to cause fatigue cracks can be developed at frequencies of the order of 1 kc. per sec. Fatigue failure of the two binary alloys containing magnesium is shown to be preceded by strain hardening.

3-187. Beryllium and Beryllium Bronze ... (Beryllium Copper). Robert Gadeau.

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Metallurgical Design

and Industrial Applications

Product Manufacturers Tell How and Why Metals Are Used in Various Ways

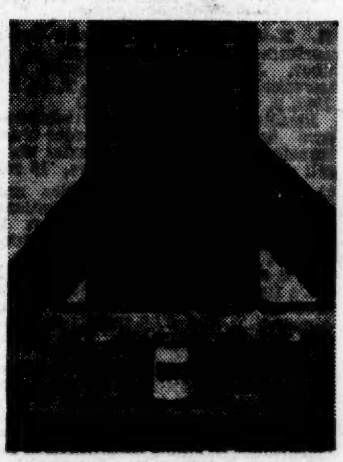
THE BROAD SUBJECT of design might be roughly divided into two categories, engineering design and industrial design—the former consisting of the study of stresses, strains, loads and deflections, and the latter more concerned with the outward appearance and utility of manufactured products. Almost the entire field of metallurgical products and metallurgical processes can be encompassed in these two categories of engineering and industrial design, and in order to keep within reasonable limits in this article, mention of many metal products and processing methods has been omitted. Selection has been made largely on the basis of whether the product or process concerned could come under the heading of one of the ten other classifications in this series of monthly reviews.

For instance, a new forging hammer might be of interest to the designer because of its ability to fabricate a part more quickly, more cheaply and more efficiently than present methods. Likewise, it might itself have interesting features of design and construction. However, since forging, rolling and stamping equipment will be covered in the November issue of *Metals Review*, a detailed description of individual machines will not be given in this present article. The same will hold for other metal processing methods such as heat treatment (covered in the January issue), machining (in the March issue), foundry practice (April), testing and inspection (May), cleaning, finishing and plating (June), and welding (July).

The Tools of the Designer

Other than drafting room equipment, the chief tools of the designer are the testing machines and instruments that enable him to determine where the stresses and strains may be concentrated in any structure or machine part, how great they are, how they are distributed, and how long both static and fatigue stresses can be endured without failure. These tools include the new tensile, creep and fatigue testing machines described in *Metals Review* for May, pages 9 to 11.

In the field of strain measurement the SR-4 bonded resistance wire gages have multiplied rapidly in number of types and sizes. Twelve different arrangements of resistance wire, with one to four wires per gage in different orientation, are now available from Baldwin Locomotive Works (R-827). Various sizes of each type bring the total available types and sizes to 88.* In one of the new gages the effective gage length has been further reduced to ⅛ in.



Baldwin SR-4 Load Cell in the Support System for a Tank to Be Weighed

Among the growing number of applications of strain gages is the Baldwin torquemeter (R-828) used to determine the turning moment of engines. A series of strain gages are bonded to the external surface of a member that is subjected to twist, and a measurement of voltage change is a measure of torque change.

Another application of the strain gage is in a fluid pressure cell for measuring and controlling gas or liquid pressure (R-829). A wire grid is bonded to the outside of a pressure-sensitive tube within the cell and connected to an indicating, recording or controlling electrical circuit. Since all external connections are electrical the possibility of leakage through joints is avoided. Any slight change in pressure changes the tension of the grid wires and thereby the electrical resistance in known relation to changes in pressure.

Load cells that operate by a similar principle have also been developed (R-830). Such cells are essentially tension or compression "spring" balances in which the spring is a short steel link or column that supports the load. By means of bonded wire grids the amount of distortion in the supporting member and the proportionate magnitude of the load are determined by electrical circuits. One of the principal applications of the load cell is in weighing tanks, particularly in the dairy industry. Load cells with capacity up to 200,000 lb. have been used in determining and maintaining constant pressures in steel rolling mills, and cells up to 1,500,000 lb. are under construction.

Two other types of strain gages, which were unobtainable during the war, have again been made available by Baldwin. These are the deForest scratch recording gage (R-831) and the Huggenberger Tensometer (R-832). The deForest gage is especially useful for attachment to fast-moving machine parts. It is self-contained, weighs less than 2 g., and records deformations of 0.0001 to 0.050 in. by a scratch pattern on a small polished chromium-plated target. The scratch record is made by an abrasive on the end of a 2-in. arm. Deformation under the gage causes longitudinal movements of the scratch arm and target relative to each other while the arm gradually "inches" across the target.

The Huggenberger, produced in Switzerland, is a light-weight, compact indicating instrument depending upon lever magnification of strains. Both laboratory and field measurements can be made easily.

A high-precision electrical extensometer which retains the simplicity and sensitivity of the bonded-wire strain gage, yet is applicable to long-term studies, is a joint development of Northrop Aircraft Co. and of Statham Laboratories (R-833). The Statham gage embodies a series of four fine-wire elements mounted under initial stress between a fixed frame and a movable armature and electrically connected in the form of a Wheatstone bridge. Movement of the armature with respect to the frame causes two of the bridge elements to increase in resistance and the other two (diagonally opposite) simultaneously to decrease in resistance, thus producing a four-fold amplification.

This basic gage was modified by mounting a doughnut-shaped clock jewel in the frame and another, exactly 1 in. distant, in the armature. Gage points mounted 1 in. apart on an aluminum base are then cemented to the structure to be tested. The pre-

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*Further information about the products described may be secured by using the Reader Service Coupon on page 54, specifying the appropriate R-number, or by writing direct to the manufacturer at the address given on page 21 or 47.

Microtechnic (English Section), v. 1, April 1947, p. 43-46.

Surveys the beryllium industry and the properties and uses of pure beryllium and of its various alloys. To be continued. (Translated from the French.)

3-188. Ligas Ferro-Manganes. Acos-Manganeses Austeniticos. (Ferromanganese Alloys. Austenitic Manganese Steels.) Clovis Bradaschia. *Boletim da Associacao Brasileira de Metais*, v. 3, April 1947, p. 251-272.

A general study of Fe-Mn and Fe-C-Mn alloys and a particular study of Hatfield steels covering composition, properties, treatment, and principal uses. 14 ref.

3-189. Fragmentation of Shell Cases. N. F. Mott. *Proceedings of the Royal Society*, v. 189, May 1, 1947, p. 300-308.

Paper is the result of attempts to find a theoretical basis for the prediction of the distribution in weight of the fragments of shell or bomb cases after detonation of the filling. Little attempt is made to relate the theory to experiment. An expression is derived for length of the average fragment. This is shown to depend on radius and velocity of the case at the moment of explosion, and on mechanical properties of the metal.

3-190. Hardenability. W. Steven. *Iron and Steel*, v. 20, June 1947, p. 299-305.

A survey of the recently published "Symposium on the Hardenability of Steel" (Iron and Steel Institute, Special Report No. 36.)

3-191. Cast Iron and Steel; Influence and Commercial Applications of Constituent Elements. (Continued.) Ernest C. Pigott. *Iron and Steel*, v. 20, June 1947, p. 307-309.

Concludes section on nickel alloys; influence of niobium, nitrogen, oxygen, and phosphorus. (To be continued.)

3-192. Effect of Dissolved Gas on the Hot Tearing of Aluminum Casting Alloys. D. C. G. Lees. *Foundry Trade Journal*, v. 82, June 5, 1947, p. 117-118.

Paper presented to the Institute of Metals.

3-193. Creep and Some Creep Resisting Alloys. G. Burns. *Metallurgia*, v. 36, June 1947, p. 63-65.

The development of materials to withstand high temperatures and stresses for use in gas turbines.

3-194. Magnesium-Cerium-Zirconium Alloys. A. J. Murphy and R. J. M. Payne. *Engineering*, v. 163, June 6, 1947, p. 485-487.

Details of experimental work on the properties of the above alloys at elevated temperatures. (Condensed from "Magnesium-Cerium-Zirconium Alloys: Properties at Elevated Temperatures", presented at meeting of Institute of Metals, March 6, 1947.)

3-195. Postwar Steels. *Chemical Age*, v. 56, June 7, 1947, p. 744-745.

Steels and their coatings.

3-196. Magnetic Dispersion of Ferric Oxide. J. B. Birks. *Nature*, v. 159, June 7, 1947, p. 775-776.

Measurements of magnetic properties previously reported are now extended to wave lengths up to 60 cm.

For additional annotations indexed in other sections, see:
4-76-86-88; 5-47; 9-71-75-77-78-80-81; 19-196; 22-357; 23-223; 27-142.

4 STRUCTURE—Metallography & Constitution

4-71. The Crystal Structure of SiC (VI) and the Geometrical Theory of the Structure of Silicon Carbide. G. S. Zhdanov and Z. V. Minervina. *Journal of Experimental and Theoretical Physics (U.S.S.R.)*, v. 17, no. 1, 1947, p. 3-8. (In Russian.)

The structure is calculated from spectrographic data of Thibault and found to be identical with that predicted by the authors in 1944.

4-72. X-Ray Study of Disorder-Order Transformation in AuCu Alloys. N. N. Buinov. *Journal of Experimental and Theoretical Physics (U.S.S.R.)*, v. 17, no. 1, 1947, p. 41-46. (In Russian.)

Results of a study of the temperature dependence of disorder-order transformation and of the axial unit-cell ratio for the above alloys. 16 ref.

4-73. Thermodynamic Activities and Diffusion in Metallic Solid Solutions. C. Ernest Birchenall and Robert F. Mehl. *Metals Technology*, v. 14, June 1947, T.P. 2168, 16 p.

It is shown that activity gradient is more fundamental than concentration gradient in the process of diffusion in copper-zinc and iron-carbon systems, and probably in general. The process of solid metallic diffusion is examined in detail. It is shown that chemical and radioactive methods for determining diffusion rates in substitutional solutions will not measure the same processes if the ratio of radioactive constituent to stable constituent is not the same on both sides of the original interface. 18 ref.

4-74. Interaction and Structure in Copper-Zinc Alloys. C. Ernest Birchenall. *Metals Technology*, v. 14, June 1947, T.P. 2169, 8 p.

Derives from activity data given in the previous paper (see above abstract) for the brasses, and from structural considerations, as much new and detailed information as possible about the interactions between copper and zinc in metallic solid solution and the effect of these interactions in determining the short-range structure of the equilibrium phases. 12 ref.

4-75. Austenite Grain Size in Cast Steels. Malcolm F. Hawkes. *Metals Technology*, v. 14, June 1947, T.P. 2170, 21 p.

More than 50 commercially produced cast steels representing a wide variety of compositions and melting practices were used in the study. For each steel, grain-size determinations were made after each of three widely varying heat treating schedules. The various methods for determining austenite grain size evaluated. An appendix consisting of five tables, giving a complete summary of austenite grain sizes of a variety of carbon and alloy cast steels after heating, has been deposited with the American Documentation Institute from whom microfilm or photocopies may be obtained.

4-76. Discussion, Institute of Metals Division. *Metals Technology*, v. 14, June 1947, T.P. 2187, 40 p.

Twinning in polycrystalline magnesium, by C. S. Barrett and C. T. Haller. Stress-rupture and creep tests on aluminum-alloy sheet at elevated temperatures, by A. E. Flanigan, L. F. Tedsen and J. E. Dorn. Precipitation in age-hardened aluminum alloys, by A. H. Geisler and F. Keller. The mechanical equation of state, by J. H. Hollomon. The melting of molybdenum in the vacuum arc, by R. M. Parke and J. L. Ham. Some factors affecting particle size of hydrogen-reduced tungsten powder, by Bernard Kopelman. Zinc diffusion in alpha brass, by A. D. Smigelskas and E. O. Bobalek. Hydrogen in magnesium alloys, by R. S. Busk and E. G. Bobalek. Some effects of zirconium on extrusion properties of magnesium-base alloys containing zinc, by J. P. Doan and G. Ansel. An electron diffraction study of oxide films formed on iron, cobalt, nickel, chromium and copper at high temperatures, by E. A. Gulbransen and J. W. Hickman. Solubility of hydrogen in electrolytic manganese and transition points in electrolytic manganese, by E. V. Potter and H. C. Lukens.

4-77. The Separation of Gases From Molten Metals. Albert J. Phillips. *Metals Technology*, v. 14, June 1947, T.P. 2208, 30 p.

Quantitative considerations of industrial significance. It is believed that any well-defined gas-metal reaction can be explained, if sufficient data are available, on the basis of simple equilibrium chemistry and the phase rule. The need for exact gas-metal equilibrium data. 17 ref.

4-78. Fundamental Investigation of Graphitization of Piping. *Edison Electric Institute Bulletin*, v. 15, May 1947, p. 171-172.

Results of research at Battelle Memorial Institute to date.

4-79. Tellurium. H. Morrogh. *Iron and Steel*, v. 20, May 23, 1947, p. 215-216.

Photomicrographs show its mode of occurrence in cast iron.

4-80. Graphite. H. Morrogh and W. J. Williams. *Iron and Steel*, v. 20, May 23, 1947, p. 241-257; discussion, p. 288-289.

Results of an extensive study of its formation in cast irons and in nickel-carbon and cobalt-carbon alloys.

4-81. X-Ray Diffraction Studies of Chromium-Steel Slags. G. P. Chatterjee and S. S. Sidhu. *Journal of Applied Physics*, v. 18, June 1947, p. 519-521.

Studies of the crystalline constituents in acid openhearth chromium steel samples showed that chromium exists in these samples as a chromium-iron spinel of the form $FeO \cdot Cr_2O_3$.

4-82. Gases Causing Unsoundness in Copper-Base Alloys. L. W. Eastwood and J. G. Kura. *Foundry*, v. 75, July 1947, p. 70-71, 200, 202, 204, 206, 208, 210, 212, 214, 216, 218-220, 222-223.

The relative importance of various types of gas-metal reactions in copper-base alloys. (Third of a series of articles based on investigations sponsored by the Non-Ferrous Ingot Metal Institute.)

4-83. Contributions to the Theory of Beta-Phase Alloys. Clarence Zener. *Physical Review*, v. 71, June 15, 1947, p. 846-851.

Beta-phase alloys, of which beta brass is the prototype, exemplify the 3/2 electron-atom rule of Hume-Rothery, and also furnish examples of order-disorder phenomena. The origin of certain other characteristics common to these alloys, including the peculiar shape of their constitution diagram, the high elastic anisotropy, and the anomalous temperature coefficient of the elastic constants E_{111} and E_{100}. 15 ref.

4-84. Recrystallization of Duplex Brass. R. W. K. Honeycombe and W. Boas. *Nature*, v. 159, June 21, 1947, p. 847-848.

Experiments in which the deformation and subsequent recrystallization of brass containing both the alpha and the beta phases were studied.

4-85. The Physics of Sheet Steel. (Continued.) G. C. Richer. *Sheet Metal Industries*, v. 24, June 1947, p. 1147-1154, 1164.

Location and structural effects of lattice impurities; carbon in iron; elastic deformation; and Young's modulus. (To be continued.)

4-86. Hardening of Metals by Internal Oxidation. J. L. Meijering and M. J. Druyvesteyn. *Philips Research Reports*, v. 2, April 1947, p. 81-102.

Certain alloys of silver, copper, and nickel can be dispersion-hardened by diffusing oxygen into them. Too

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also distance between them, with respect to a 1.000-in. standard, can be measured by pressing the extensometer down upon the points of the needles. Any relative movement of the jewels results in a bridge unbalance which can be read on an indicating instrument. The complete extensometer weighs only 3 oz.

A strain-gage amplifier (R-834) manufactured by General Electric Co. can be used with resistance-wire, electromagnetic or magnetostrictive strain gages. It consists of a 5000-cycle oscillator unit, a power unit, and either two or six identical amplifier units. The amplifier channels are stabilized against line voltage change or variations in tube characteristics, and each can be removed for servicing and inspection.

Stresscoat (R-835), a product of Magnaflux Corp., is a series of calibrated brittle coatings that are used in experimental stress analysis work to give an over-all picture of stress distribution. Recent improvements in techniques have extended the use of the method to measurements of residual stresses by a relaxation method, and measurements of stresses in parts under actual service loadings where temperatures do not exceed 100° F. Tests can be made down to 30° F. Busses and trucks have been tested on the road under service conditions, and tests made of bridges and similar structures in place under service loads.

The coatings are sprayed on, then air dried. The first cracks that appear in the coating during a test indicate points of highest stress, and predict points of failure under fatigue loadings. Test results will serve as a guide for redistribution of metal from low to high stressed points, thus giving parts which are lighter in weight and easier to manufacture.

The complete Model ST-103 Stresscoat outfit required for this work was described in the May *Metals Review*.

When accurate knowledge of the causes, effects and characteristics of surface irregularities is desired, the designer turns to various types of surface analyzers. Some of these were described in the May issue of *Metals Review*, page 17. The Proficorder (R-836) recently announced by Physicists Research Co. is a mechanical-electronic shop instrument that provides a magnified chart record of the shape, height and spacing of surface irregularities.

The equipment includes a tracer with diamond point; a piloting fixture with motor-driven slide for moving the tracer; and an Amplicorder unit, consisting of an amplifier, chart recording mechanism and control panel. Various tracers and piloting fixtures provide for flat or cylindrical surfaces, external or internal, and remote portions of large base plates, rolls and cylinder bores.

During the war, the desirability of extremely low ranges in carbon content of steel, particularly of stainless steel, was explored. Development of

Low-Range Carbon Determinator

a carbon determinator that permits heretofore unattainable accuracy in analyzing for these minute quantities of carbon is expected to broaden the field of uses for these low-carbon stainless steels. This carbon determinator, manufactured by Laboratory Equipment Corp. (R-837), is equipped with compensators accurate to 0.0005%. It has a carbon range from 0.00 to 0.200%, and is completely automatic, controlled by several simple dials.

Materials for the Designer

Improvements and refinements in the Strain-Tempering process developed some time ago by Bliss & Laughlin, Inc., have been made during the past year to improve ductility or increase hardness, tensile strength and yield strength, along with relief of cold working strain (R-838). Strain-Tempering is a controlled, subcritical annealing treatment applied to bar steels *after* the cold finishing operations. It is not confined to any particular grade of steel or type of finish, but is used in the production of all cold drawn rounds and shapes. A wide range of physical property combinations is provided by selecting the steel grade, method of cold finishing, amount of workhardening, and temperature of Strain-Tempering.

Medium carbon grades such as C-1045, C-1141, C-1144, cold worked and Strain-Tempered, develop tensile strengths of 125,000 psi. with satisfactory ductility. Savings in manufacturing costs result from the elimination of subsequent heat treatment.

Introduced by the Vanadium-Alloys Steel Co., a new free-machining die steel known as Speed-Cut (R-839) permits alteration in fabricating methods and design for dies used in the die-casting and plastics industries. This steel is available heat treated to Brinell 260 to 300 and in sizes as large as 20x10 in. It can be readily machined without subsequent heat treatment, so that no allowance need be made for movement or surface removal after heat treatment. For die-casting dies Speed-Cut is usually purchased in the heat treated condition. At a hardness of Brinell 275 it machines as readily as fully annealed steels.

A new 35% cobalt, 64% iron, 1% chromium alloy that carries more magnetism than any other alloy practical for use in motors and generators and is tough enough to withstand intense vibration has been developed by Trygve D. Yensen of the Westinghouse Research Laboratories in collaboration with J. K. Stanley. The new alloy, Hiperco (R-840), will make possible compact electric motors and generators an estimated 10% smaller and lighter than those of equal power now built for aircraft.

The combination of 35% cobalt with iron gives the highest magnetic saturation point of any known metallic material, and the 1% chromium is added to make the alloy workable. Early samples of Hiperco were extremely brittle, but a method of rolling has been devised which produces a tissue-thin strip of metal tough enough to withstand intense vibration and yet ductile enough to be bent double without breaking. Brittleness can be avoided either by quenching the alloy in cool water or by continuous rolling while the hot metal cools.

Rigidized Metal, made by Rigid-Tex Corp. (R-841), while a prewar development, has been manufactured and marketed actively only within the past

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Samples of Rigidized Metal in Various Patterns

small an affinity leads to a coarser distribution of the oxide formed, because conglomeration must take place via the atoms, and dissociation occurs more frequently when the oxide is not very stable. Thermodynamic considerations of the reaction front are given. 10 ref.

4-87. Diagrama de Transformacao do Ferro Fundido Cinzento. (Transformation Diagram of Gray Cast Iron.) Fabio Decourt Homem de Melo. *Boletim da Associacao Brasileira de Metais*, v. 3, April 1947, p. 360-376.

The transformation through which gray cast iron passes while cooling in a mold is affected by the rate of cooling.

4-88. Acos Grafiticos. (Graphitic Steels.) Tomio Kitice. *Boletim da Associacao Brasileira de Metais*, v. 3, April 1947, p. 273-290.

A preliminary study of the stability of cementite, with comments on the nature of graphitization and the effects of various chemical compositions. Various graphitic steels, their sources, properties, and applications. 20 ref.

4-89. Stress Relaxation Across Grain Boundaries in Metals. T'ing-Sui Kê. *Physical Review*, v. 72, July 1, 1947, p. 41-46.

In order to elucidate further the concept of relaxation of shear stress across grain boundaries in metals, the temperature dependence of internal friction and rigidity modulus of 99.991% aluminum have been measured as a function of frequency of torsional vibration and as a function of grain size of the specimen.

For additional annotations indexed in other sections, see:
3-168; 6-136; 11-90; 18-118; 21-62; 22-342; 27-133.

5 POWDER METALLURGY

5-43. Postwar Activities of the Metallwerk Plansee in Reutte (Tyrol). Paul Schwarzkopf. *Powder Metallurgy Bulletin*, v. 2, May 1947, p. 52-53.

New developments in powder metallurgy at the above plant.

5-44. Sintered Iron and Steel for Structural Parts. R. Kieffer, F. Benesovsky, and H. J. Bartels. *Powder Metallurgy Bulletin*, v. 2, May 1947, p. 54-69.

Properties, applications, and production techniques for a variety of articles and parts. European developments. 40 ref.

5-45. Polyvinyl Acetate in Powder Metallurgy. Harry L. Strauss, Jr. *Modern Plastics*, v. 24, June 1947, p. 196, 198.

Process uses a resistance-heated carbon die which applies variable heat and pressure from 100 to 2400° F. With this process, such metals as copper, tin, nickel, and zinc can be alloyed and hot pressed under adjustable heat and pressure to produce alloy metals having a wide range of applications. Five per cent polyvinyl acetate is added to improve the flowability of the mass, thus making it possible to produce odd-shaped items.

5-46. Recent Developments in Powder Metallurgy. J. A. Judd. *Engineering Materials*, v. 5, Feb-April 1947, p. 6-13.

A review.

5-47. Sintered Permanent Magnets. S. J. Garvin. *Engineering*, v. 163, May 30, 1947, p. 445-446; June 6, 1947, p. 465-467.

The general principles and applications of powder metallurgy; the problems involved in the production of Alnico and Alcomax alloys by sintering. A study of the phase diagrams of Al-Fe, Al-Ni, and Al-Co alloys led to the selection of an Al-Fe alloy containing 48% Fe as the most suitable for the liquid phase, which must be present to facilitate sintering. The second installment discusses the basic principles for preparation of the compacts, and illustrates a number of special forms of the magnets. Magnetic properties of the different cast and sintered alloys.

5-48. How to Evaluate Engineering Properties of Iron Powder Parts. Alexander Squire. *Materials & Methods*, v. 25, June 1947, p. 89-93.

Correlation between mechanical properties and performance characteristics. Results of experiments on the relationships between processing conditions and quality characteristics. Direct use of mechanical tests seldom gives a true picture as to the ability of similarly produced parts to perform satisfactorily.

5-49. A Challenge: Powder Metallurgy. A. J. Langhammer. *Modern Metals*, v. 3, June 1947, p. 13.

Properties and applications of the various Oilite bearing metals and alloys. Potential applications and metallurgical improvements desired. One of these is an oxide-free aluminum powder.

5-50. Modern Powder Metallurgy. H. W. Greenwood. *Engineering*, v. 163, June 13, 1947, p. 492.

A general discussion of recent progress.

5-51. Rate of Sintering of Copper Powder. A. J. Shaler and J. Wulff. *Physical Review*, v. 72, July 1, 1947, p. 79-80.

Equations are derived for rate of shrinkage, at various temperatures, of powder aggregates containing many pores of uniform size. Equations are also derived to include the presence of foreign gases inside the pores and outside the aggregate.

For additional annotations indexed in other sections, see:
4-76; 23-217; 27-148.

6 CORROSION

6-135. Rust, Industry's Arch Enemy. Thomas Trail. *Power Plant Engineering*, v. 51, June 1947, p. 84-86.

Seriousness of rust in the life of industrial equipment; theory of rust; requirements of preservative coatings; use of colors to provide contrast between coats of protective coatings; preparation of surfaces preliminary to applying protective coatings; special treatment for galvanized iron; and paints for various surfaces.

6-136. New Theory for Corrosion of Carbon Steel. William C. Uhl. *Petroleum Processing*, v. 2, June 1947, p. 405-408.

Theory asserts that the structure of the carbide crystals in steels is the important factor controlling corrosion. Metal surface areas rich in lamellar pearlite are said to be more resistant than areas in which the carbide structure is in spheroidized form.

6-137. Corrosion Control With Calgon. Owen Rice. *Journal of the American Water Works Association*, v. 39, June 1947, p. 552-560.

The use and value of the above sodium phosphate glass for prevention of formation of calcium carbonate boiler scale, for corrosion control, for prevention of precipitation of dissolved iron and manganese, and for tuberculation control.

6-138. Corrosion Retarding of Aluminum Alloys. Rick Mansell. *Organic Finishing*, v. 8, May 1947, p. 25, 27-32.

(To be concluded.)

6-139. Cathodic Protection of Steel Tank Bottoms by the Use of Magnesium Anodes. J. R. James and R. L. Featherly. *Petroleum Technology*, v. 10, May 1947, T. P. 2202, 7 p.

Results obtained from tests and commercial installations on two 55,000-bbl. and two 20,000-bbl. tanks. Potential measurements taken a few months after completion of the installation indicated that the potential could be reduced and still provide adequate protection. Costs are calculated to be only 1% of the previous tank-bottom replacement costs.

6-140. Corrosion Processes. U. R. Evans. *Metal Industry*, v. 70, May 9, 1947, p. 335-337.

British contributions to their understanding. 38 ref. (To be concluded.)

6-141. Corrosion. Mars G. Fontana. *Industrial and Engineering Chemistry*, v. 39, June 1947, p. 87A-88A.

Resulting from a combination of corrosion and mechanical action, and means of evaluating test specimens for resistance to this type of deterioration. Effects of pH on rate of steel corrosion, and effect of copper in sulphuric acid slurry on erosion-corrosion of 18-8 S Mo stainless.

6-142. Corrosion Studies for the Petroleum Refining Industry. Part I. F. A. Rohrman. *Petroleum Refiner*, v. 26, June 1947, p. 85-90.

The economic aspects of corrosion and basic corrosion theory. (To be continued.)

6-143. Corrosion—in High-Pressure Gas-Condensate Wells—Gulf Coast Area. T. S. Zajac. *Oil and Gas Journal*, v. 46, June 28, 1947, p. 102-105, 107.

History, scope, causes, characteristics, cooperative work done by the industry, field methods of corrosion prevention, cost, and future work to be done on gas-condensate well corrosion.

6-144. Nature and Mechanism of Passivity of 18-8 S Stainless Steel. M. G. Fontana and F. H. Beck. *Metal Progress*, v. 51, June 1947, p. 939-944.

First report from the research program on the fundamentals of corrosion sponsored by the Office of Naval Research at Ohio State University shows that a passivated surface of low-carbon 18-8 becomes active after exposure to vacuum, and again becomes passive by exposure to air, the action thus being reversible. Electron diffraction gives no indication of oxide layers on passivated surfaces. A physically adsorbed layer of weakly held gas molecules is believed responsible for the phenomenon.

6-145. Effect of Sulphur Bacteria on Corrosion. L. Liberthson. *Iron and Steel Engineer*, v. 24, June 1947, p. 69-72; discussion, p. 72-73.

The phenomenon of bacterial deterioration of cutting-oil emulsions is used as an illustrative link to indicate why and how sulphur-reducing bacteria may well be regarded as a subject for study by the industrial microbiologist. The literature is briefly surveyed to emphasize the connection between the lines of investigation familiar to the iron and steel technologist and the lines normally regarded as primarily biological, and to underline the research trends and possibilities in the field of corrosion of iron and steel. 20 ref.

6-146. Corrosion Testing: Evaluation of Metals for Process Equipment. A. Wachter and R. S. Treseder. *Chemical Engineering Progress (Transactions Section)*, v. 43, June 1947, p. 315-326.

Considerations involved in planning, conducting, and interpreting tests. Details of experimental methods and a criterion for evaluating results.

6-147. Corrosion Prevention by Vapor-Type Inhibitor. *Iron Age*, v. 159, June 19, 1947, p. 80.

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12 months. It is the product of a patented process whereby most ferrous and nonferrous flat rolled metals can be given a two-dimensional pattern of alternating high and low areas. The metal is cold flowed into any f numerous geometric patterns by a process in which the metal is redistributed away from the neutral axis.

The resultant increased structural rigidity permits use of lighter gage metal with a minimum of bracing, maintains flatness and eliminates bulging in large flat areas or paneling on curved surfaces. The textured surface is decorative, mar resistant and durable. Rigidized Metal is being used for seat backs, door kick plates, and interior trim; for refrigerator parts, lighting fixtures and soda fountains.

Bottom Liner for Laundry Centrifuge Spun From Stainless Steel

Introduction this year of nickel and Monel to Superior Steel Corp.'s SuVeneer clad metal production gives fabricators a choice of two new bimetals (R-842). The metals are bonded to one or both sides of low-carbon steel strip. The resulting bimetal can be fabricated in the cold by any standard method without effect on the bond. SuVeneer clad metal serves wherever the relatively costly nickel and copper alloys are not required in solid form, but are used for their surface values.

Aluminum-clad strip stock is now being produced by P. R. Mallory & Co., Inc., either as a duplex or triplex metal (R-843). Mallory's new process provides an adherent coating and an extremely ductile bond between the aluminum and the steel. This material is useful for parts requiring the strength of steel combined with the corrosion resistance of aluminum, such as gas engine bearings and other antifriction parts.

A new use for stainless-clad steel, according to Jessop Steel Co. (R-844), is in automobile bumpers—an application instigated by the shortage of chromium and nickel plating equipment. Perfection of stainless clad fabrication methods has made the method entirely practical for bumpers and other automobile accessories that are entirely free from pitting, flaking and rusting.

Development for the first time of seamless molybdenum tubing in commercial quantities has been announced by Callite Tungsten Corp. (R-845). The tubing is being made in sizes ranging from 0.040 to 0.500 in. outside diameter and up to 9 in. long. It can be readily machined, is easily worked and shaped, and can be welded to iron, nickel and similar materials. It is not affected by hydrofluoric acid, potassium or sodium hydroxide, and only slightly by nitrogen. Westinghouse Electric Corp. has also recently announced new facilities enabling the production of molybdenum sheet and other rolled shapes in hitherto unobtainable sizes (R-846).

Fabricating Methods

An interesting example of how a recently developed process solved a problem in sheet metal forming is described by the Solar Aircraft Co. (R-847), originators of the Sol-A-Die process, which depends upon a simplified routine method for making stage or restrike dies. The part was a "wing trailing edge fillet" formed from 24S-O Alclad sheet 0.025 in. thick, later heat treated to 24S-T. It was impossible to draw the part by conventional methods without wrinkles, which, when removed, left marks and blemishes. Furthermore, the distortion caused by heat treatment could not be removed by the usual restrike.

The causes of these difficulties are apparent from inspection of the final shape, shown at the right of the illustration below. The sharper radius of only 3/16 in. tends to thin or fail in staging or restrike, and the 100-in. longitudinal radius in the saddle forms compression wrinkles in the nearly vertical faces of the part. When attempting to correct the latter by restraining the edges, the form is aggravated and the additional deformation increases the distortion in heat treatment.

In the Sol-A-Die process, the part is stamped to full size in a very shallow first stage which develops the required differential areas. The final die folds the preformed blank. The necessary draw is decentralized and the shallow slopes and use of rubber in the first stage allow careful control of metal movement, practically eliminating wrinkles. Stress concentrations are kept low, and the only deformation is the final fold.

Wing Trailing Edge Fillet Stamped by Sol-A-Die Process. Left is the blank preformed to full size; final shape is at right

An unusual accomplishment in the spinning of metals is pointed out by Milwaukee Metal Spinning Co. (R-848). This company has for many years used a ductile, light-gage copper alloy to manufacture bottom liners for laundry centrifuges. The completed unit resembles a Mexican sombrero and involves a severe draw even for a soft copper alloy (see photo in Col. 1).

Recent experiments in spinning the part in the much more difficult stainless steel and Monel have given entirely satisfactory results. The liner is now being spun from 18-gage Type 304 stainless steel without annealing and without tearing. It is 60 in. in diameter with a cone 16 in. deep beginning with an angle 30° off the vertical centerline and blending into a 24° angle 5 in. from the top.

A money-saving redesign of a cast part is described in a folder issued by Racine Steel Castings Co. (R-849). The part is a tandem unit support to be bolted on the frame of a four-ton truck and attached to the rear axle. It carries the full weight of the truck body. The original casting was designed as a box section and required over 100 lb. of core sand. A simpler new design eliminated the large core, lowered costs and increased the strength of the part.

Use of steel plate welded construction is exemplified in a line of power squaring shears designed by Harold Verson for Parker Mfg. Co. (R-850). Such equipment is generally made of cast iron, but the greater strength and rigidity of welded steel plate construction permits increased capacity without additional weight and floor space.

An example of structural welding is the Herman Professional Building in Houston, Texas, now nearing completion. This 14-story building is one of the tallest ever erected by welding, according to Lincoln Electric Co. (R-851), which furnished 40,000 lb. of Fleetweld No. 5 electrodes to fabricate the 1400 tons of structural steel used.

Use of welding in place of riveting is a design feature of a new box car produced by Pullman-Standard Car Mfg. Co. (R-853). Submerged-arc welding is used to join the sides of the car; ends and roofs, draft lugs and center fillets are welded. Pullman-Standard has also designed some unique equipment for multiple spot welding of plates to shapes. (See July *Metals Review*, page 10).

An improved line of Eureka tool and die welding electrodes recently announced by Welding Equipment & Supply Co. (R-854) can be used for arc welding almost all types of toolsteel. Dies for blanking, forming, forging, drawing, embossing, coining, and hot and cold trimming can be salvaged or reclaimed. Damaged or discarded tools can be reworked. Composite die units can be fabricated.

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New product furnished as an alcoholic solution is used to impregnate containers for finished parts to prevent corrosion during storage and shipment. Slow evaporation is said to produce a vapor which inhibits corrosion.

6-148. Diesel Wear Related to Per Cent Sulphur in Fuel. *SAE Journal*, v. 55, July 1947, p. 70.

Effects of sulphur, nitrogen, and naphthenic acid on the rate of wear in diesel engines. (Digest of "Effects of Nitrogen and Sulphur Content of Fuels on Rate of Wear in Diesel Engines," by C. C. Moore and W. L. Kent.)

6-149. Chimney Liner Corrosion Resulting From Gas-Fired Furnaces. George B. Johnson. *Gas Age*, v. 100, July 10, 1947, p. 29-32, 72.

Results of a survey made by Minneapolis Gas Light Co. Three major types of liners have been used to prevent corrosion. These are: asphalt chromate emulsion on specially coated steel (Wilder metal); plastic coating on steel; and aluminum. Of the three types, aluminum has given the best results with manufactured gas.

6-150. The Corrosion of Elektron AM503 Sheet in Chloride Solutions and the Effect of Fluoride Additions and Concentration Variations. C. J. Bushrod. *Magnesium Review and Abstracts*, v. 6 Oct. 1946, p. 132-138.

In order to obtain information on the corrosive action of welding fluxes, corrosion tests were conducted on specimens of Elektron AM503 magnesium-base alloy sheet immersed in chloride and fluoride solutions. It was found that fluoride additions were dangerous unless present in very large relative concentration, when they completely inhibited attack. Reducing the concentration of chloride ions in the absence of fluoride ions caused the attack to become much less general, and pitting occurred with increasing frequency. It was concluded that the composition of all fluoride noncorrosive welding fluxes cannot safely be modified to produce lower melting-point mixtures by the addition of small quantities of chlorides.

6-151. The Corrosion of Iron and Steel and Its Prevention. J. C. Hudson. *Official Digest*, v. 264, Jan. 1947, p. 26-39; discussion, p. 40-42.

British test program and results obtained. The corrosion of bare iron and steel; protective measures against rusting; protective coatings for iron and steel; protective coatings for heavy structural iron or steelwork; and protective coatings for light-gage iron and steel parts.

6-152. Corrosion of Underground Cable Sheaths Due to Local Cells. L. F. Greve. *Proceedings of the Midwest Power Conference*, v. 9, 1947, p. 190-197.

Methods employed by a large utility company for mitigating the extremely troublesome corrosive conditions due to local cells on the underground cable system.

6-153. The Corrosion of Some Magnesium-Base Alloys (High and Normal Purity) in Contact With Other Metals. F. A. Fox and J. K. Davies. *Journal of the Institute of Metals*, v. 14, May 1947, p. 553-566.

Results of a study of the corrosion of magnesium-base alloys immersed in 3% sodium chloride solution saturated with magnesium hydroxide, while in electrical contact with other metals. While the galvanic corrosion of many magnesium-base alloys is anodically controlled, the magnesium-aluminum alloys behave differently. It is suggested that the surface anodic film is unstable and nonadherent, and that the corrosion is controlled by cathodic reactions.

6-154. Note on the Quantitative Implications of Hanawalt's Theory of Corrosion of Magnesium-Base Alloys. C. J. Bushrod. *Journal of the Institute of Metals*, v. 14, May 1947, p. 567-572.

The above theory is developed on a quantitative basis. The resulting equation is shown to agree with experimental results previously obtained, using two alloys of differing iron content. It is suggested that the equation should be fitted to results obtained from alloys in which the impurities were subject to closer control but, in addition, *a priori* reasons are given for supposing that the basis theory is incorrect.

6-155. Contact Corrosion Problems in the Metal Window Industry. E. F. Pellowe and F. F. Pollak. *Metallurgia*, v. 36, June 1947, p. 67-70.

The contact corrosion of cast aluminum to steel, galvanized steel, brass, pure aluminum, and stainless steel. Accurately weighed disks of the various materials were placed in contact, then immersed in salt solution and water followed by a period of drying. This treatment continued for several weeks and the samples were then cleaned and re-weighed. Results are correlated with A.S.T.M. data. 11 ref.

6-156. Steam Turbine Lubrication Problems and Their Solutions. Part IV. Primary Rusting. Alan Wolf. *Petroleum*, v. 10, June 1947, p. 134-136.

Painting of oil reservoirs; indications of oil deterioration; rusting in new turbines; corrosion inhibitors; corrosion research results. (To be continued.)

6-157. The Corrosion of Metals; Zinc and Its Alloys. Part VII. *Sheet Metal Industries*, v. 24, June 1947, p. 1207-1211.

Bimetallic couple with zinc; atmospheric corrosion; natural, distilled, and sea-water attack; effect of temperature; protective-film composition; chemical corrosion in batteries; corrosion in miscellaneous domestic applications. (To be continued.)

6-158. Corrosion of Filters in Sugar Refineries. Part II. Investigations on Prepared Liquors. H. Inglesent and J. Anderson Storrow. *Industrial Chemist*, v. 23, June 1947, p. 373-379.

How liquors and electrodes were prepared; measurement of potential; results obtained with cane sugar and glucose syrup liquors; the effect of chloride content; the brass-phosphor bronze cell; need for prespecification tests.

6-159. Cathodic Protection of Pipelines. H. Seymour. *Mining Magazine*, v. 76, June 1947, p. 339-340.

Use of magnesium alloy anodes to prolong the life of buried pipes.

6-160. Companies Unite Against Ravages of Salt Water in Research at Kure Beach Ocean Laboratory. Warren W. Burns. *Oil and Gas Journal*, v. 46, June 28, 1947, p. 107-108, 111.

Research facilities and programs for prevention of salt-water corrosion of metals, for prevention of fouling, and for prevention of marine-borer attack on wooden structures at Kure Beach.

6-161. Corrosion in High-Pressure Gas Condensate Wells—Gulf Coast Area. Part II. T. S. Zajac. *Oil and Gas Journal*, v. 46, June 28, 1947, p. 127, 129-130, 132, 135, 136, 138, 141-142.

Various inspection methods and methods for prevention and alleviation. 14 ref.

6-162. Scientific Attack on Corrosion Under Way. *Chemical and Engineering News*, v. 25, June 30, 1947, p. 1859.

Reviews papers presented at the first university conference on Corrosion and Metal Protection at the Museum of Science and Industry, Chicago, June 11 through 13.

6-163. Corrosion Rates of Metals Determined by Extensive Tests. *Machinery*, v. 53, July 1947, p. 164-166.

Cooperative test program at Kure Beach, N. C., for iron, steel, and steel alloys exposed to salt water and salt-water atmospheres.

6-164. Correct Materials Make Feed Pumps Immune to Corrosion-Erosion. H. L. Ross. *Power*, v. 91, July 1947, p. 86-88.

The six causes of corrosion-erosion in boiler-water feed pumps. Resistance of the different metals and alloys commonly used for these pumps. Suggestions for alleviation of trouble in carbon steel pumps now in operation.

For additional annotations indexed in other sections, see: 3-184; 4-76; 7-240-243-246-262; 12-109; 27-135.

7 CLEANING & FINISHING

7-234. Insulated Infrared in the Finishing Industry. William J. Miskella. *Organic Finishing*, v. 8, May 1947, p. 9, 11, 13-15, 17, 38.

Use of insulation and proper lamp spacing for reduced costs and better products.

7-235. Navy Bureau of Aeronautics Colloquium on Protective Coatings. George W. Grupp. *Organic Finishing*, v. 8, May 1947, p. 19-23, 32.

Reviews papers presented.

7-236. Dyeing Anodized Aluminum. J. P. Gill. *Metal Industry*, v. 70, May 9, 1947, p. 340-341.

Method used and selection of dyestuffs. 13 ref. (Concluded.)

7-237. Metal Spraying. *Metal Industry*, v. 70, May 9, 1947, p. 345.

Use of a sprayed-zinc undercoat on lacquered metal furniture prevented cracking caused by flexing of the chairs during use.

7-238. Aluminum Glamourized by Color. Phil Glanzer. *Tool Engineer*, v. 18, June 1947, p. 39-40.

New finishing techniques.

7-239. Preparation of Automotive Parts for Painting by Phosphate-Spray Coating. *Industrial Heating*, v. 14, June 1947, p. 981-982, 984.

Materials-handling system of Parker-Wolverine Div., Udylite Corp., Detroit, used in connection with bonderizing of auto-body parts.

7-240. Burdett Incorporates Rust-Proofing Treatment Into Its Burn-Off Process. *Industrial Heating*, v. 14, June 1947, p. 986, 988.

New Burdett burn-off rustproofing process consists primarily of the proper placing of gas-fired infrared burners in relation to the work. This process is claimed to not only remove grease and similar film, but simultaneously produce a blue surface on the metal that is extremely rust resistant.

7-241. Stripping Finishing Materials. George Conrad. *Organic Finishing*, v. 8, June 1947, p. 9, 11-13.

Various methods.

7-242. Electrostatic Spraying Methods. *Organic Finishing*, v. 8, June 1947, p. 15, 17-19.

A general discussion.

7-243. Corrosion Retarding of Aluminum Alloys. Rick Mansell. *Organic Finishing*, v. 8, June 1947, p. 21, 23-25, 27-29.

Survey of the selection of organic coatings for the above. (Concluded.)

7-244. Plastic Resins as Protective Coatings. Paul O. Blackmore. *Organic Finishing*, v. 8, June 1947, p. 30-33, 36, 38.

Alkyds; urea and melamine; acrylics; polystyrene; vinyls; vinylidene chloride; and silicones. (Concluded.)

7-245. New Types of Silver Coatings. Peter P. Hopf. *Electronic Engineering*, v. 19, June 1947, p. 193-194, 198.

An improved silvering preparation

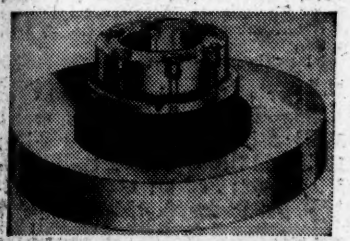
(Turn to page 18)

Toolsteel welding differs from hard facing in that the weld deposits are hard, as-welded, but they can be annealed to facilitate machining, and afterwards heat treated and tempered. The electrodes themselves are in the annealed condition, but the weld metal is hardened by air quenching and self quenching from the high heat of the arc.

In designing tools and dies, changes in contours, corners or edges can be readily made by welding during the die try-out or change-over periods. Composite tools can be made from carbon steels by welding the cutting edges or working areas with Eureka toolsteel electrodes.

Another development of interest to the tool and machine designer has been announced by Carboloy Co. (R-855). This is a process for solidly embedding machinable materials into carbide parts so that they can be mounted or attached with screws or studs. Potential fields of application for carbides, particularly in large sections, are thereby considerably expanded.

Tapped blind holes are possible,



Phantom View of Attachment by Studs of Carboloy Insert in Punch and Die Set

which means that large wear parts may be bolted down rigidly and yet present an unbroken wear surface. Attaching carbide dies with threaded parts permits the carbide to seat solidly against the back-up metal, with consequent increased impact resistance. This attachment method also lends itself to the economical building up of a complex-shaped die or other part from groups of small individual units, as in a progressive die.

Assembly and Finishing

Of special interest to designers of aluminum and magnesium articles is a 10-ton hydraulically operated assembly press added to the line manufactured by Colonial Broach Co. (R-856). The feature that makes it particularly advantageous when assembling relatively delicate parts is a working pressure of 1200 psi. maximum, which is adjustable through a knurled dial on the front of the machine to any desired amount below this.

Replacement of castings and forgings by assemblies of stampings and screw machine components has been furthered by developments in copper brazing with controlled-atmosphere electric furnaces. In the domestic range

Brazed Assembly For Gas Range Burner

industry both top and oven burners are now being made of steel stampings, copper brazed in the Chicago plant of Salkover Metal Processing, Inc. (R-857). The illustration shows component parts and sectioned views of the top burner for a well-known gas range.

Advantages of the method are that no machining is required and exact dimensions can be held, simplifying assembly of the burners into the stove. Smooth interior surfaces reduce resistance to gas flow and increase combustion efficiency. The brazed assembly is not brittle and will not break when dropped. Over-all cost is lower than for a cast iron burner.*

Two low-temperature silver brazing alloys known as Easy-Flo 45 and Easy-Flo 35 were recently introduced by Handy & Harman and were described in the July issue of *Metals Review*, page 17. An example of their application is in the assembly of a drive shaft, bearing retainer and spider of a lawn motor rotor (R-858). These three parts are brazed together with one ring of Easy-Flo 45. Four assemblies are brazed at once; 3840 assemblies are produced per 8-hr. day on one two-station induction heating unit.

An integral unit that cannot be produced by normal machining methods, but has been readily made by the Oilite powder metal process is one of the newer accomplishments of the Amplex Division of Chrysler Corp. (R-859). This is a close coupled cluster gear set of high accuracy and smooth operation. The entire tooling program for this part was completed in a few weeks, with production started three days later. This is just one example of the highly stressed machine parts that are now being made by powder metallurgy to replace heavy stampings, steel bars and steel forgings.

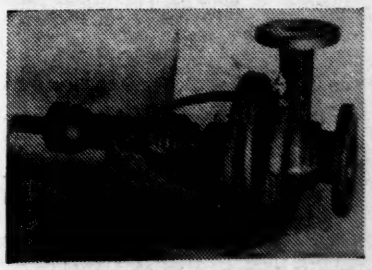
Painting and coating is a field that has been given little consideration in designing new products. With the electrostatic spray and electrostatic detearing processes, however, Harper J. Ransburg Co. points out (R-861) that a wide range of articles can be painted automatically with savings ranging from 30 to 65%.

*Another interesting example of assembly by brazing is described in "Critical Points" in the August issue of *Metal Progress*, page 230. This is a torque converter for White Motor Co. busses consisting of an assembly of aluminum parts made by furnace brazing. The converter transmits 200 hp. between engine and gear box.

Compound Gear Made by Oilite Powder Metal Process

Design of Mechanical Elements

A list of all the new and novel mechanical parts and devices introduced during the past year would be well-nigh endless; hence those described in what follows may only be considered as illustrative examples.



Ampco Metal Centrifugal Pump

A new line of seamless welding fittings has been introduced by Tube-Turns, Inc. (R-862) in Type 304, 347 and 316 stainless steel. They are available in a wide variety of fittings including elbows, Tees, caps, reducers, and all types of threaded flanges. The three types of steel will handle a wide range of applications from the mild requirements of the food and dairy industries, to highly corrosive conditions in paper and textile mills.

Ladish Co.'s new line of seamless welding fittings in carbon steel (R-863) features a new tapered Tee design. By careful metal distribution, the center sections and crotch are reinforced, the metal tapering off to nominal pipe size at the ends. This design provides greater strength and durability in severe service.

A new centrifugal pump produced from noncorrosive aluminum bronze is the lateat product of Ampco Metal (R-865). This is a single-stage, single-sec-

(Turn to page 19)

and an improved technique for applying printed circuits to nonmetallic materials, especially ceramics. The material is a stabilized colloid of metallic silver containing a minimum amount of silver oxide. The usual silk-screen printing method is replaced by an offset-printing technique. An alternate method especially useful for application to plastics consists of fusing the silver to the plastic by high-frequency heating.

7-246. The Use of Porcelain Enamel to Resist Corrosion. J. E. Hansen. *Enamelist*, v. 24, June 1947, p. 4-11, 54.

Properties and applications.

7-247. Progress of Westinghouse and Industry Development to Reduce Chippage and Losses on Porcelain Enameled Ranges. R. F. Bisbee. *Enamelist*, v. 24, June 1947, p. 12-25, 60.

Improvements in manufacturing and shipping procedures.

7-248. Magnetic Holding Method for Silk-Screen Processing. W. A. Barrows and E. H. Brandenburg. *Enamelist*, v. 24, June 1947, p. 34-35, 54.

Process in which electromagnets are used to hold enameled-steel sheets during silk-screen processing.

7-249. Barrel Finishing of Metal Products. Part X. Factors in the Evaluation of Steel Burnishing Materials. H. Leroy Beaver. *Products Finishing*, v. 2, June 1947, p. 74-76, 78, 82, 84.

Relative efficiencies of various sizes and mixtures of sizes of balls.

7-250. Electrolytic Polishing of Magnesium. George Black. *Metal Finishing*, v. 45, June 1947, p. 86-87, 94.

Methods for anodic polishing of magnesium alloys as described in British patents.

7-251. Applications of Metallic Coatings. Rick Mansell. *Metal Finishing*, v. 45, June 1947, p. 91-94.

Cleaning, finishing, mechanical coating, and electrodeposition processes. (Concluded.)

7-252. Infrared Finishing Ovens. Ira J. Barber. *Paint and Varnish Production Manager*, v. 27, June 1947, p. 147-148, 150, 152, 167.

Paints and ovens for infrared baking, time-temperature combinations, costs.

7-253. Degreasing. *Metal Industry*, v. 70, June 6, 1947, p. 425.

Use of a synthetic wetting agent made by Shell Petroleum, Ltd.

7-254. Man-Sized Improvements at Modest Cost. *Modern Industry*, v. 13, June 15, 1947, p. 81-82, 87.

Improved pickling setup at Republic Steel Corp.'s Massillon, Ohio, plant.

7-255. Reflector Finishing Process. Ralph Pettit. *Steel*, v. 120, June 23, 1947, p. 114, 117.

Use of "Alzak" electrolytic process in which the surface is first electropolished, then anodized to produce a transparent, protective coating of aluminum oxide.

7-256. Modern Wire Pickling Practice and Plant Design. Part II. Copper Rod Pickling. Edward Mulcahy. *Wire Industry*, v. 14, June 1947, p. 321-322, 330.

Procedures for the pickling of copper rod and wire, and also for recovery of copper by the electrolytic and copper sulphate crystallization processes. (To be continued.)

7-257. Finishing and Inspection. D. F. Sawtelle. *American Foundryman*, v. 11, June 1947, p. 44-46.

Procedures followed in mechanized malleable foundry of Malleable Iron Fitting Co., Branford, Conn.

7-258. Floyd-Wells Modernization Program Nearing Completion. *Better Enameling*, v. 18, June 1947, p. 9-10.

Equipment and procedures of stove manufacturing, especially pickling and enameling phases.

7-259. Manufacturing Economies Result From Barrel Finishing. Herbert Chase. *Materials & Methods*, v. 25, June 1947, p. 84-88.

Use of barrel finishing to deburr, burnish, hone, and perform other finishing operations on large as well as small parts made of a wide variety of metals.

7-260. Cleaning of Metals. C. A. Snavely. *Metals Review*, v. 20, June 1947, p. 5-6.

New developments in evaluation of cleaners, acid pickling, cleaning with molten salts and blast cleaning, reported in the literature for the past year.

7-261. Metal Finishing. E. L. Combs. *Metals Review*, v. 20, June 1947, p. 6-7.

New developments in polishing and buffing, metal coloring, anodizing, metal spraying, and hot dipping reported in the literature for the past year.

7-262. Equipment for the Finishing Department. *Metals Review*, v. 20, June 1947, p. 9-15, 17-18, 20, 22, 24, 26, 28, 30.

149 new products and processes for metal cleaning, rustproofing, coating, and plating reported during 1946. List of manufacturers and their addresses.

7-263. Vitreous Enamel. Its Preparation and Application. D. S. O'Donnell. *Canadian Chemistry and Process Industries*, v. 31, June 1947, p. 527-529, 535.

Operations at the enamel plant of Frigidaire Products of Canada, Ltd., Leaside, Ont.

7-264. Aluminum as a Reflector. *Light Metals*, v. 10, June 1947, p. 297-303.

Observations on front-surfaced mirrors; the reflection of infrared radiation and reflectivity of aluminum paint. (Concluded.)

7-265. Alodizing Aluminum. Norman P. Gentieu. *Industrial Finishing*, v. 23, June 1947, p. 34-36, 40, 42, 44, 46.

Chemical surface treatment for aluminum. Recommended methods for preparing the surface for the treatment; for applying it; and for cleaning, rinsing, and drying after application.

7-266. How Buick Finishes Hoods, Fenders and Wheels. Larry Strong and H. F. Reves. *Industrial Finishing*, v. 23, June 1947, p. 49-50, 52, 54, 56.

Techniques described and illustrated.

7-267. Roller Coating Endless Metal Strips. I. Basso. *Industrial Finishing*, v. 23, June 1947, p. 59, 61, 62, 64, 66.

Color is rolled on two sides and two edges of metal strips for venetian-blind slats. The operation is continuous and automatic.

7-268. Preheating Products Before Painting. Gilbert C. Close. *Industrial Finishing*, v. 23, June 1947, p. 68, 70.

Products are heated before being painted instead of afterward to speed drying of coatings.

7-269. Tin Coating Mechanite. *Iron Age*, v. 159, June 26, 1947, p. 57.

Results obtainable with each of two successful procedures—fused-chloride and fused-nitrate dipping.

7-270. Organic Finishes for Magnesium Alloys. Allen G. Gray. *Steel*, v. 120, June 30, 1947, p. 73-74, 101.

Various finishing materials, their specific uses, and methods of applying. (Concluded.)

7-271. Flame-Priming Overcomes Moisture. *Linde Tips*, v. 26, July 1947, p. 83-84.

How corroded dam gates of hydroelectric plant were restored by flame-priming.

7-272. Electrostatic Finishing Doubles Spray-Coat Production. W. B. Stephenson. *Production Engineering & Management*, v. 20, July 1947, p. 75-76.

Average savings of 50% on paint material and considerably greater savings on labor result from use of new method by Delta Electric Products Co.

7-273. Cast Iron Chill Roll Stainless Clad in 24 Hours. David Jenkins. *Metco News*, v. 4, July 1947, p. 2-3.

How cast-iron roll is given the same corrosion resistant characteristics as solid stainless.

7-274. Cutting Maintenance Costs. Major Repairs Within Scheduled Shutdowns. Daniel L. Cannie. *Metco News*, v. 4, July 1947, p. 4-5.

Repair of worn or corroded journals and bearing shafts by metallizing at Continental Paper Company's paperboard plant at Ridgefield Park, N. J.

7-275. Short Cuts in Shaft Work. *Metco News*, v. 4, July 1947, p. 11-12.

Improved setup for spray metallizing.

7-276. Sealing Lead Coatings by Shotblasting. *Metco News*, v. 4, July 1947, p. 14-15.

Investigation which showed that a light undercoat of Metcoloy No. 1 or 2, or of Sprasteel No. 10, would permit shotblasting of sprayed lead coatings without destroying the bond.

7-277. Production Clinic for Finishing Die Castings. *Die Castings*, v. 5, July 1947, p. 51-52.

Methods used in selection and application of organic finishes for magnesium die castings.

7-278. Electro-Erosion—a New Tool for Metal Working. Robert Magidoff. *Welding Engineer*, v. 32, July 1947, p. 64, 66, 68.

New process invented by Soviet technicians for drilling, slotting, cutting, grinding or, by reverse action, electroplating. A spark discharge (not an arc) is produced, which erodes away the surface.

7-279. Electrostatic Forces Aid Paint Spray Techniques. *Electronic Industries & Electronic Instrumentation*, July 1947, p. 6-7.

Descriptive.

For additional annotations indexed in other sections, see:
3-195; 6-135-138-149-151; 8-102-106; 10-119; 14-183; 15-24; 19-196; 20-359; 21-62; 22-333; 23-213-239; 26-93; 27-121-135-137.

8 ELECTROPLATING

8-89. Glass-to-Metal Seals. N. S. Freedman. *Metal Industry*, v. 70, May 23, 1947, p. 378-380.

A plating process for the electrodeposition of silver on steel which satisfactorily withstands the high-temperature processing encountered in the manufacture of electron tubes for high-frequency operation.

8-90. Bright Copper Plating. Harold Leever. *Die Castings*, v. 5, June 1947, p. 52, 54, 56.

New process for plating zinc die castings from copper cyanide solution.

8-91. Copper Plating in Alkanesulphonic Acid Baths. (Continued.) C. L. Faust, B. Agruss, E. L. Combs, and Wayne A. Proell. *Monthly Review*, v. 34, June 1947, p. 709-719.

Variables in copper alkanesulphonic acid plating baths. Advantages and limitations. Bent-cathode tests for throwing power, copper-plate grain size, and anode behavior; a cell-voltage comparison between copper alkanesulphonic acid and copper fluoborate baths; an evaluation of the effect of iron and lead impurities; and results of a life test.

8-92. Overvoltage Required for Evolution of Hydrogen at High Current Densities. A. G. Pecherckaia and V. V. Stender

(Turn to page 20)

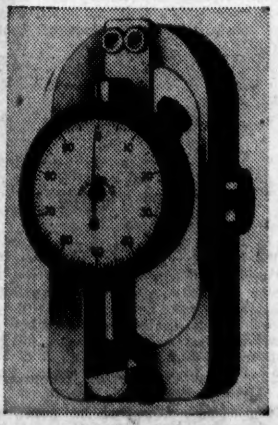
...closed impeller model, suitable ...r handling acids, salts, and alkalis. ...hree-stage oil diffusion pumps de...gned by National Research Corp. (R-866) are recommended for large ...ating operations and vacuum fur...aces. These pumps will deliver 8500 ...u.ft. per min. at 0.1 micron. Jets are ...un aluminum; all other parts ex...sed to vacuum are stainless steel.

A low-priced, light-duty universal ...oint of ingenious patented design has ...en developed by Curtis Universal ...oint Co. (R-867). The design elimi...ates sliding friction and minimizes ...earing friction, making the use of ...oots, covers and excessive lubrica...ion unnecessary. The forks of this ...all-type joint are steel and bear on a ...bronze ball, with heat treated center...ss ground pivot bearing pins.

The Halfco spherical self-aligning ...earing manufactured by Adel Preci...ion Products Co. (R-868) consists of ...nly two pieces. The outer race is of ...ard bronze, integrally formed around ...a hardened, highly polished, precision ...ground steel ball.

A compact instrument to indicate ...pressures in mechanical assemblies is ...provided by the Dillon mechanical pres...ure gage made by W. C. Dillon & Co. (R-869). It is designed to slip into a ...mall space and measure working loads ...in tight spots or in heretofore inac...cessible machine setups. A jeweled dial ...indicator is mounted to a V-shaped ...pressure bar in such a way as to trans...late amount of deformation directly ...into pounds pressure. It can be used ...for checking testing instruments and ...presses, for moving filaments, for com...pressive loads and shafts in motion.

The new improved Variable-V-Planetary infinite ratio speed selector, jointly announced by Speed Selector, Inc., and the B. F. Goodrich Co. (R-870) is designed as an independently mounted transmission. It employs planetary motion with four variable pitch sheaves and two standard cross-section V-belts to provide any speed from zero to 800 r.p.m. at constant torque, from a constant speed power source. The multiplying action of the planetary converts a slight change in sheave pitch diameter to a wide change in output speed.

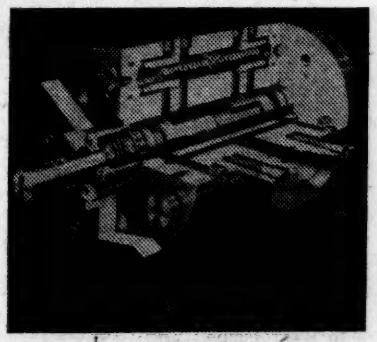


Dillon Mechanical Pressure Gage

Power Units and Electrical Equipment

A new hydraulic power unit announced by Hufford Machine Works (R-871) is suitable for both manual and automatic operations. It is completely self-contained, with motor, pump, valves and flow controls mounted above the hydraulic fluid reservoir and filter system. Munton Mfg. Co.'s Mobil-Power unit (R-872) can be conveniently carried anywhere in the plant; it consists of a 7-ton hydraulic jack with 3-in. ram stroke, a foot-power mechanism, and an 8-ft. hydraulic line with swivel coupling.

Working pressures substantially higher than those normally obtained with high-pressure pumps are provided by the new oil hydraulic pressure booster made by Hydro-Power, Inc. (R-873). A compact, multiplunger intensifier, the Hydro-Power booster is capable of supplying pressures up to 7500 lb. and will multiply by as much as three times the pressure of the oil it handles in a hydraulic circuit.



Hydro-Power Booster

A type of rectifier equipment which has potential application in industrial processes other than electroplating has been developed by W. Green Electric Co., Inc. (R-874). The new feature of these rectifiers is the incorporation of automatic stabilization. While a practicable method of stabilizing the output voltage of low-voltage, high-current rectifier equipment was developed by this company several years ago, it is only recently that automatic stabilization of current has been added. In these installations a master control unit maintains either the voltage or the amperes constant.

The wide use of dielectric and induction heating in industrial processing has demanded electronic tubes more rugged both electrically and mechanically than those conventionally used in communications equipment, and such an industrial tube has been developed by Machlett Laboratories as the ML-5604 (R-875). Rugged construction is provided by a heavy-wall anode, by silver brazed connections, by proper shape of the glass envelope, by heavily plated Kovar seals, by proper grid support and design, and by use of tantalum in all high-temperature portions of the grid assembly.

Machlett Electronic Tube for Industrial Processing

Fasteners

Originally manufactured only to special order, Cherry Monel blind rivets (R-876) are now a standard product of Cherry Rivet Co. All the features of the regular Cherry line are incorporated in these fasteners for corrosion resistant parts. They are made in two types—self-plugging and pull-through hollow—and in two head styles—modified brazier and 100° countersunk.

A new edition of the 40-page "Rivnut Data Book" published by the B. F. Goodrich Co. (R-877) describes these one-piece blind fasteners in detail, including test data, information on thread strength, eccentric, double and single and tension loads, and torque resistance.

Numberless variations of the Speed Nut system of spring tension fastenings have been introduced by Tinnerman Products, Inc., for special purposes (R-878). An example is the assembly of multiple coil forms on radios with one fastener which combines five Speed Nuts; it replaced eight separate parts and eliminated drilling and tapping operations. Another, used in assembly of parking lamps, performs three functions—retaining the light socket, spacing the wires, and fastening the entire assembly to the base.

Light Metal Applications

The expanded capacity for aluminum and magnesium is finding outlet in a myriad of new postwar applications. Some interesting examples cited by Aluminum Co. of America are portable aluminum irrigation pipe (R-879), piano plates (R-880) and insulated electrical wires and cables (R-881).

The irrigation pipe is extruded from Alcoa 63 S-T and has a yield strength of 30,000 psi. and tensile strength of

(Turn to page 21)

Journal of Applied Chemistry (U.S.S.R.), v. 19, no. 12, 1946, p. 1303-1312. (In Russian.)

Overvoltages necessary were determined for an extensive series of metals, at a series of current densities from 10^{-3} to 1.0 amp. per sq.cm. 26 ref.

8-93. Barrel Plated Multiple Coatings. Mario Mazzone and Floyd McKnight. *Metal Finishing*, v. 45, June 1947, p. 81-85.

Use of barrel plating of toy-train parts using copper, nickel, chromium, zinc, silver, and black oxidizing.

8-94. Rectifiers for Electroplating. Part III. Louis W. Reinken. *Metal Finishing*, v. 45, June 1947, p. 88-90.

Dual output rectifier unit; multi-output units; series-connected rectifiers for anodizing; and standard rectifiers in group operation. (Concluded.)

8-95. Electroplating Nonconductors. Thomas A. Dickinson. *Metal Finishing*, v. 45, June 1947, p. 95.

Copper, black-nickel, chromium, and gold plating of plastics or other nonmetallics.

8-96. Chrome Plating of Aluminum. A. R. MacPherson. *Light Metal Age*, v. 5, June 1947, p. 8-9.

Procedures for manufacture of chromium-plated aluminum household fixtures and accessories at Camp Manufacturing & Sales Co., Tacoma, Wash.

8-97. Electroplating. *Automobile Engineer*, v. 37, June 1947, p. 227-229.

The periodic reverse-current process.

8-98. The Control and Maintenance of Electroplating Solutions. Part III. P. Berger. *Sheet Metal Industries*, v. 24, June 1947, p. 1187-1195, 1201.

Chromium solutions. (To be continued.)

8-99. Plating of Die Castings. *Western Metals*, v. 5, June 1947, p. 34-36.

Plating processes with reference to the methods used at the Fisher-Ternstedt division of General Motors.

8-100. Electroplating. W. H. Safranek. *Metals Review*, v. 20, June 1947, p. 7-8, 47.

New developments in special-purpose chromium plates, electroplating of bearings, electroforming, plating aluminum alloys, decorative and protective plates reported in the literature for the past year.

8-101. Automatic Conveyers for Electroplating. Adolph Bregman. *Iron Age*, v. 159, June 19, 1947, p. 68-74.

Design, selection, and operating characteristics of automatic conveyers for electroplating equipment. The development of automatic units, major types of machines available and where each type may be most effectively used.

8-102. Plating Smallwares. Parts I and II. R. MacNair. *Metal Industry*, v. 70, June 6, 1947, p. 423-425; June 20, 1947, p. 464-466.

The finishing of small articles by barrel polishing and barrel plating. The type of equipment available, the abrasive media used, the preparation of the work, methods of scale removal, and the barrel polishing of cast iron, mild steel, bright steel articles, and small brass die-castings.

8-103. Automatic Conveyers for Electroplating. Adolph Bregman. *Iron Age*, v. 159, June 26, 1947, p. 58-64.

Advantages and limitations of automatic electroplating equipment. Plating costs with full automatic conveyers; operating characteristics of a number of automatic conveyers available for plating work.

8-104. Engineering Electroforming. M. H. Orbaugh. *Monthly Review*, v. 34, July 1947, p. 810-815.

History, techniques, applications, materials, and allied processes (selective deposition for building up worn or improperly machined parts, and metal coating of nonconductors).

8-105. Porosity of Electrodeposited Metals. Part III. Critical Literature Review. N. Thon and E. T. Addison. *Monthly Review*, v. 34, July 1947, p. 831-842.

Methods of determination of total porosity; correlation between porosity and corrosion-exposure tests; results and conclusions of porosity investigations; causes and nature of porosity. (To be continued.)

8-106. Finishing of Zinc-Base Die-Castings. Parts I and II. C. F. Nixon. *American Machinist*, v. 91, July 3, 1947, p. 149, 151.

From paper presented before the American Electroplaters' Society.

8-107. Bright Zinc Plating Cuts Costs at Philco Plant. Clarence W. Smith. *Iron Age*, v. 160, July 10, 1947, p. 46-49.

Use of bright zinc plating on sheet-metal radio and television-set parts, in place of cadmium, has resulted in savings of $100,000 per year at the Philco Corp. Philadelphia plant. Equipment and procedures used in applying this finish rapidly and efficiently.

For additional annotations indexed in other sections, see:
6-138; 7-251-262-278; 9-74; 11-69-75-90; 12-109-120; 23-209-213; 25-97; 27-135.

9 PHYSICAL TESTING

9-71. Interpretation of Creep and Stress-Rupture Data. Francis B. Foley. *Metal Progress*, v. 51, June 1947, p. 951-958.

Methods of creep testing, the interpretation of the results, and the mechanism of flow and fracture under long continued loads at high temperature. The latter considerations are then used to indicate methods for obtaining better service from existing alloys, and for devising alloys for extreme conditions.

9-72. Predicting Creep Strength. P. G. McVetty. *Metal Progress*, v. 51, June 1947, p. 959-960.

Referring to the method for predicting creep strength proposed by Kelvin Sproule in the March issue, the author suggests caution in any extrapolation to lower temperatures.

9-73. Indentation Methods for Measuring Wear. *Tool Engineer*, v. 18, June 1947, p. 41-43.

McKee Wear Gage developed at National Bureau of Standards measures extremely small increments of wear—as little as 0.00001 in. under favorable conditions. Narrow diamond-shaped markings that show a definite change in one or more readily measurable dimensions after relatively small amounts of wear are applied to the working surfaces.

9-74. Bolt Tension Vs. Installation Torque on Zinc and Cadmium-Plated Nuts, Bolts and Washers. Wilbur Gross. *Monthly Review*, v. 34, July 1947, p. 818-822.

Test results are tabulated and charted for various types of assemblies and combinations.

9-75. Brinell Hardness Does Not Measure Machinability. Georg Schlesinger. *American Machinist*, v. 91, July 17, 1947, p. 125-136.

The results of reliable tests made in the United States, Europe, and Great Britain. The accumulated data on material, Brinell hardness, cutting speed, tool life, power consumption, and specific cutting resistance show the true status of Brinell as a criterion of machinability.

9-76. Discussion of Paper: "Correlated Brittle Fracture of Notched Bars and Simple Structures". Wendell P. Roop. *Welding Journal*, v. 26, June 1947, p. 333s-334s, 351s.

Extensive discussion refers to paper by MacGregor, Grossman, and Shea published in Jan. issue. Author reply.

9-77. The Tensile-Shear Stress Ratio Rolled Copper Alloys. Maurice Co and T. Ll. Richards. *Journal of Institute of Metals*, v. 14, May 1947, 541-551.

Value of the ratio of shear stress ultimate tensile stress decreased fr about 0.8 for annealed to about 0.5 hard rolled strip. The high values annealed and less heavily rolled str are due to the considerable uniform elongation and consequent reducti in cross-sectional area which occu before test-pieces of such material f in tension. When the shear stress related to the true tensile stress, th ratio approximates 0.5, and is inde pendent of the condition of the mat rial.

9-78. The Evaluation of Mechanic Properties of High-Tensile Steel W Welded Structures. Otto Graf. *Weldi Journal*, v. 26, June 1947, p. 367s-368s.

Results of a series of experiment which included examination of struc ture, chemical analysis, usual mechan ical properties, creep at constant loa pulsating fatigue limit, bending test, behavior of large I-beams bending, on a series of low-alloy steel containing various amounts of Si, Mn Cr, Mo, and Al. (Translated and ab stracted from *V. D. I. Zeitschrift*, 87, July 10, 1943, p. 422.)

9-79. High Temperature Testing. Part W. E. Kuhn. *Canadian Metals & Metal lurgical Industries*, v. 10, June 1947, 27-29, 50.

The effect of high temperature o metals and the planning and organ izing of an intelligent test program.

9-80. High Creep Strength Austeniti Gas Turbine Forgings. (Concluded) D. A. Oliver and G. T. Harris. *Engineer* v. 183, June 6, 1947, p. 502-503.

Results of experimental work o creep of G.18B and R.20 steels. Th use of creep data for solid rotor forg ings and the present state of gas tur bine development from the metallurgi cal point of view. General observa tions on the creep testing of materia at elevated temperature. (Condense from paper presented to Institute o Marine Engineers, April 1947.)

9-81. Gas Turbine Forgings. D. A Oliver and G. T. Harris. *Iron and Steel* v. 20, June 1947, p. 333-336.

Development of high-creep-strength austenitic steels. (Paper presented t the Institute of Marine Engineers. To be concluded.)

For additional annotations indexed in other sections, see:
3-176-186; 4-76; 6-148; 12-114; 21-62; 22-340; 27-136.

10 ANALYSIS

10-103. Potentiometric Determination of Iron Using a "Comparative Electrode" (a Platinum-Ferric Ion Solution). Dushan Zhivanovich. *Journal of Applied Chemistry (U.S.S.R.)*, v. 19, no. 10-11, 1946, p. 1225-1230. (In Russian.)

Results using the Dickens-Thanheiser electrode—reported from Germany in 1932. A modified form of this electrode gave the most accurate results. The electrode described may also be used for the determination of chromium as chromate.

10-104. Determination of Manganese in Iron Ores. Esler R. Bechtel, Jr., and W. G. Crowle. *Chemist Analyst*, v. 36, Feb. 1947, p. 4-8.

Procedure using titration with ar-

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35,000 psi. It is available in 20-ft. lengths of 2 to 8 in. diameter. One length of 4-in pipe weighs only 19 lb., and the irrigation systems are easily transported from field to field as needed.

The piano plates are the result of 20 years of research, aided materially by the use of Stresscoat analysis applied to a finished and strung plate to locate areas of stress concentration. Whereas a typical cast iron plate for a spinet piano weighs in the neighborhood of 125 lb., and requires two men to handle in the piano factory, its aluminum one-man counterpart weighs only 45 lb.

Aluminum Piano Plate

Aluminum Co. has also announced production of a new aluminum roofing material for industrial use to supplement its standard Alcoa roofing sheet already in use on farm buildings (R-882). The special alloy for industrial roofing and siding combines high strength, high resistance to industrial atmospheres, minimum maintenance and reduced roof load. Production of aluminum roofing and siding will also be undertaken by a new building materials division of the Permanente Metals Corp. (R-883).

Unusual new applications of Reynolds Metals Co.'s aluminum alloys are for knock-down truck and trailer bodies (R-884), a home freezer unit (R-885), and an all-aluminum shipping pallet (R-886). The truck and trailer bodies are fabricated from standard panels and hardware parts and shipped knocked down to distributors; coupled to the weight-saving advantage is the ready repair by substitution of complete standard sections in case of accident. The home freezer uses aluminum for food compartment, outer shell and cover and weighs only 185 lb. The all-aluminum pallet (for use with fork-truck handling equipment) slashes shipping costs by removing two-thirds the weight of the usual steel pallet.

Reynolds' building products include aluminum clapboard siding, corrugated roofing and siding, shingles, Snap-Seal roofing in interlocking sheets, and "Reynalite", a building panel made of two sheets of aluminum bonded to a cellulose core (R-887).

In the construction of its all-metal trailer coaches, Westcraft, Inc. (R-888) uses aluminum for all parts except floors, intercostal strips, inner lining and cabinets. An extraordinary variety of expanded shapes minimizes assembly costs. Permanente Metals Corp. supplies the aluminum for this manufacturer in various gages and degrees of hardness. Adapting fabrication methods developed by aircraft manufacturers, Westcraft draws roof ends from 60x120-in. sheet of 0.051-in. 38-O aluminum using a Kirksite die on a large hydraulic press; the roof ends are drawn out 18¾ in.

The ultimate of weight saving is exemplified by the piano plate of magnesium alloy, according to Dow Chemical Co. (R-889). This plate, weighing 22 lb., is for a 64-key piano weighing only 80 lb. complete! On the other end of the scale, magnesium cement block pallets and holding wedges for the logging industry (R-890) are being made in sand and permanent mold castings. Another new application based on the nonsparking characteristics of magnesium is in car loading tubes for transferring liquid fuel (R-891). Miniature racing cars which hold the world's speed record are made of magnesium (R-892).

Weight of a standardized truck body made of magnesium is 1060 lb., in contrast to 2300 lb. when made of steel. Standard structural shapes and sheets for this truck were supplied by Revere Copper and Brass, Inc. (R-893). No sheet metal forming is required; fabrication and assembly are by clamping, drilling and riveting.

Miscellaneous Product Applications

There have been so many developments in the use of nickel and nickel alloys that International Nickel Co. finds it difficult to select any one or two which might be described as outstanding. Choosing by the blindfold method, we come up with a floating marsh buggy (R-894) that penetrates areas that are impassable for boats, cars and trucks. For salt water and other corrosive services the buggy's huge drum-like wheels are made of Monel, which can also take heavy punishment from wear and abrasion.

More than 150 tons of nickel-clad steel recently went into the manufacture of four reactor vessels for an oil refinery (R-895). Six feet in diameter and 35 ft. long, they are the largest pressure vessels ever made of this material.

Uses of stainless steel in three important fields—namely, the meat packing industry, the petroleum industry and the dairy industry—are described in three booklets recently published by Allegheny Ludlum Steel Corp. (R-897). Each booklet covers specific applications and shows how performance records forecast future duties.

Stainless steel tubing 3 to 3½ in. in diameter is being used for heating coils in the manufacture of penicillin and other antibiotics, according to Babcock & Wilcox Tube Co. (R-898). The culture medium is heated by steam circulated through these tubes. The outside of the tubing is in contact with the mold, which requires absolutely sterile conditions for proper growth.

Addresses of Manufacturers

Adel Precision Products Corp. (R-868)
Burbank, Calif.

Allegheny Ludlum Steel Corp. (R-897)
2020 Oliver Bldg.
Pittsburgh, Pa.

Aluminum Co. of America
(R-879, 880, 881, 882)
Pittsburgh 19, Pa.

Ampco Metal, Inc. (R-865)
1745 S. 38th St.
Milwaukee 4, Wis.

Amplex Division (R-859)
Chrysler Corp.
Detroit, Mich.

Babcock & Wilcox Tube Co. (R-898)
85 Liberty St.
New York 6, N. Y.

Baldwin Locomotive Wks.
(R-827, 828, 829, 830, 831, 832)
Philadelphia 42, Pa.

Bliss & Laughlin, Inc. (R-838)
Harvey, Ill.

Callite Tungsten Corp. (R-845)
540 39th St.
Union City, N. J.

Carboloy Co., Inc. (R-855)
11129 E. 8 Mile Rd.
Detroit 32, Mich.

Cherry Rivet Co. (R-876)
231 Winston St.
Los Angeles 13, Calif.

Colonial Broach Co. (R-856)
Box 37 Harper Sta.
Detroit 13, Mich.

Curtis Universal Joint Co. (R-867)
Springfield 7, Mass.

Dillon Co., Inc., W. C. (R-869)
5410 W. Harrison St.
Chicago 44, Ill.

Dow Chemical Co. (R-889, 890, 891,
Midland, Mich. 892)

General Electric Co. (R-834)
Schenectady 1, N. Y.

Goodrich Co., B. F. (R-870, 877)
Akron, Ohio

Green Electric Co., W. (R-874)
130 Cedar St.
New York 6, N. Y.

Handy & Harman (R-858)
82 Fulton St.
New York 7, N. Y.

Hufford Machine Works (R-871)
Redondo Beach, Calif.

Hydro-Power, Inc. (R-873)
Belmont & Sheridan Ave.
Springfield, Ohio

International Nickel Co. (R-894, 895)
67 Wall Street
New York 5, N. Y.

Jessop Steel Co. (R-844)
Washington, Pa.

Laboratory Equipment Corp. (R-837)
Benton Harbor, Mich.

Ladish Co. (R-863)
Cudahy, Wis.

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semite-nitrite after oxidation by persulphate.

10-105. Microchemical Analysis. E. J. Vaughan and C. Whalley. *Iron and Steel*, v. 20, May 23, 1947, p. 269-275.

Details of a scheme for determination of various elements in ferrous alloys. 17 ref.

10-106. Cobalt Analysis. V. D. Ponomarev. *Metal Industry*, v. 70, May 30, 1947, p. 405.

Colorimetric determination in the presence of iron or nickel. (Translated and abstracted from *Journal of General Chemistry, U.S.S.R.*)

10-107. The Polarographic Determination of Tin in High-Purity Zinc and Zinc Die-Casting Alloys. R. C. Hawkings, D. Simpson, and H. G. Thode. *Canadian Journal of Research*, v. 25, Section B, May 1947, p. 322-330.

Procedure for the determination of tin in high-purity zinc and zinc die-casting alloys in amounts from 0.001 to 0.2%. The samples are dissolved in sulphuric acid, oxidized with hydrogen peroxide, precipitated with cupferron, redissolved and reduced, and finally the tin is determined polarographically. Accuracy is ± 2.0% for amounts less than 0.005%. 12 ref.

10-108. The Microchemical Determination of Molybdenum in Steel. J. E. Wells and R. Pemberton. *Analyst*, v. 72, May 1947, p. 185-188.

A colorimetric method for the determination of molybdenum in milligram quantities of steel. The method involves the use of toluene-3:4-dithiol in amyl acetate solution, and is virtually specific for molybdenum in steel.

10-109. A Method for the Determination of Tungsten in Steel, Using Toluene-3:4-Dithiol. The Removal of Molybdenum Interference by Selective Extraction. B. Bagshawe and R. J. Truman. *Analyst*, v. 72, May 1947, p. 189-193.

New method is applicable to a wide variety of alloy steels and provides the first satisfactory method for determining tungsten in percentages below 1.0%.

10-110. The Determination of Tin and Copper in Phosphor-Bronze. Brian B. Bach. *Metallurgia*, v. 36, June 1947, p. 65-66.

Methods are proposed in order to overcome difficulties introduced by the presence of phosphorus and are designed to give accurate results in reasonable time. Modifications are suggested to cover other copper alloys.

10-111. Determination of Small Amounts of Copper in Metallic Aluminum by Means of Internal Electrolysis. *Metallurgia*, v. 36, June 1947, p. 110.

Outlines work reported in *Zavodskaia Laboratoriya (U.S.S.R.)* in two papers (1941 and 1945).

10-112. Microchemistry in Great Britain and Belgium. A. Lacourt. *Metallurgia*, v. 36, June 1947, p. 101-103.

Wartime progress and techniques used at the Center of Microchemistry of the University of Brussels.

10-113. Examination of Absolute and Comparative Methods of Polarographic Analysis. John Keenan Taylor. *Analytical Chemistry*, v. 19, June 1947, p. 368-372.

Advantages and limitations of several methods of these two types. 24 ref.

10-114. Zirconium Determination in Presence of Interfering Elements. Charles A. Kumins. *Analytical Chemistry*, v. 19, June 1947, p. 376-377.

Method described entails the precipitation of zirconium with mandelic acid from a hydrochloric acid solution as a zirconium mandelate. It will separate it quantitatively from titanium, iron, vanadium, aluminum, chromium, thorium, cerium, tin, barium, calcium, copper, bismuth, antimony, and cadmium.

10-115. 2,2'-Bipyridine Ferrous Complex Ion as Indicator in the Determination of Iron. F. Wm. Cagle, Jr. and G. Frederick Smith. *Analytical Chemistry*, v. 19, June 1947, p. 384-385.

Above complex is suitable for use as an oxidation-reduction indicator in the determination of iron by cerate oxidimetry, following the use of sulphuric acid solutions with the Jones reductor for reduction of iron. Its preparation and advantages on a cost basis.

10-116. Determination of Carbon in Low-Carbon Steel. Charles E. Nesbitt and James Henderson. *Analytical Chemistry*, v. 19, June 1947, p. 401-404.

New apparatus and procedure for determining carbon content of plain and alloyed steels up to 0.05% carbon, with an accuracy of ± 0.0003%. Procedure requires about one hour and consists of burning a 2-g. sample in a stream of purified oxygen, collecting the CO_2 evolved in a special absorber containing a solution of NaOH, acidifying this solution, and measuring the CO_2 evolved.

10-117. Determination of Thorium and Its Separation From Uranium by Ferron. D. E. Ryan, W. J. McDonnell, and F. E. Beamish. *Analytical Chemistry*, v. 19, June 1947, p. 416-417.

A gravimetric method.

10-118. Determination of Oxygen in Steel by the Vacuum Fusion Method. Leroy Alexander, W. M. Murray, and S. E. Q. Ashley. *Analytical Chemistry*, v. 19, June 1947, p. 417-422.

A simplified apparatus and a modified operational plan. Relatively continuous operation is achieved, with consequent saving in analysis time. A method for the measurement of oxygen and hydrogen in surface films. 17 ref.

10-119. Analysis of Waste Pickle Liquor. R. D. Hoak. *Iron Age*, v. 160, July 3, 1947, p. 55-57.

Reliable methods for analysis of waste pickle liquors. Analysis procedures for manganese, zinc, and copper, as well as a rapid test for basicity of lime used for pickle-liquor disposal under any combination of temperature and reaction-time conditions.

10-120. Identification of War Steel Bar Stock. Part I. A. W. Ehlers. *Tool & Die Journal*, v. 13, July 1947, p. 76-78, 149, 150.

Spark testing.

For additional annotations indexed in other sections, see: 27-141.

11 INSTRUMENTS Laboratory Apparatus

11-69. Porosity of Electrodeposited Metals. A. E. S. Research Project No. 6. Part II. Critical Literature Review. (Continued.) N. Thon and E. T. Addison, Jr. *Monthly Review*, v. 34, June 1947, p. 722-730.

Hot water tests; tests for cathodic metal deposits; electrographic methods; salt-spray tests; and impregnation methods. (To be continued.)

11-70. The Use of an Underfeed Stoker Applied to a New Type of Assay Furnace. E. A. C. Rubidge. *Journal of the Chemical, Metallurgical and Mining Society*, v. 47, Feb. 1947, p. 300-316.

Design and operating details of furnace used in connection with large-scale assaying of gold ores.

11-71. Some Photographic Aspects of Industrial Radiography. Herman E. Seemann. *Industrial Radiography & Non-Destructive Testing*, v. 5, Spring 1947, p. 9-15.

The nature of radiation and the structure of a photographic emulsion. Practical information concerning recommended techniques.

11-72. A Proposed Pulsed X-Ray Generator for High Speed Diffraction Studies. D. M. McCutcheon, S. G. Knoch, and C. T. Waldie. *Industrial Radiography & Non-Destructive Testing*, v. 5, Spring 1947, p. 16-18, 20.

Instrument, it is believed, will solve the problem of the industrial application of X-ray diffraction, which has been severely hampered by the excessive time required in order to obtain a photographic record of the pattern.

11-73. The Radioactive Integrator, a New Area Measuring Instrument. Marietta Blau and Jack R. Carlin. *Industrial Radiography & Non-Destructive Testing*, v. 5, Spring 1947, p. 19-20.

Instrument uses polonium as a source of alpha particles; a few possible applications.

11-74. Testing Materials for Internal Discontinuities With Supersonic Echoes. J. W. Dice. *Industrial Radiography & Non-Destructive Testing*, v. 5, Spring 1947, p. 29-33.

Use of supersonic Reflectoscope.

11-75. Electrochemical Jet Test. A. Ogarev. *Metal Industry*, v. 70, May 9, 1947, p. 338-340.

A method for determination of thicknesses of electrodeposited coatings. A direct current is passed through the stream of liquid flowing through a capillary on to the sample, the latter being made the positive, and the capillary the negative, electrode. At the spot where the jet meets the sample, electrochemical solution of the plated metal takes place. When the base metal is exposed a marked change of current strength takes place, which indicates the end point. (Translated from a recent issue of *Journal of Applied Chemistry (U.S.S.R.).*)

11-76. Adapt Electronic Digital Counters as Process Aid. *Electronic Industries & Electron Instrumentation*, v. 1, June 1947, p. 2-3.

How the above may be used.

11-77. Single Crystal Electron Diffraction by Microcrystalline Materials. Norman Davidson and James Hillier. *Journal of Applied Physics*, v. 18, June 1947, p. 499-511.

Reports on the phenomena observed using a mode of operation of the electron diffraction camera described by Hillier and Baker wherein a beam of electrons, reduced to a probe of approximately 200A cross section, and of maximum angular aperture approximately 7.5×10^{-3} radian, is diffracted by single microcrystals; and of correlating the morphology and orientation of a particular crystal with its diffraction patterns from single microcrystals.

11-78. Objective Aperture System for the Electron Microscope. Cecil E. Hall. *Journal of Applied Physics*, v. 18, June 1947, p. 588-589.

System is attached to the specimen cartridge rather than to the lens; procedures for its use. Advantages over the conventional system and representative results.

11-79. Polishing Metallographic Specimens With Diamond Dust. Gordon C. Woodside and Harold H. Blackett. *Metal Progress*, v. 51, June 1947, p. 945-947.

Grinding and polishing technique, using diamond dust pastes, in the preparation of carbide and other specimens.

11-80. Identification of Delta Constituent in Aluminum Bronzes. David J. Mack and M. A. Shurman. *Metal Progress*, v. 51, June 1947, p. 976-977.

Disadvantages of commonly used or recommended etching reagents are overcome by use of an "aged" NH_4OH-H_2O_2 solution.

11-81. Improved Ice Calorimeter in High-Temperature Research. *Technical News Bulletin (National Bureau of Standards)*, v. 31, June 1947, p. 63-65.

Instrument has the following desirable characteristics: First, its precision is very good; second, its sensitivity

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F. P. Zimmerli Named Sauveur Medalist

F. P. Zimmerli, chief engineer of the Barnes-Gibson-Raymond Division of the Associated Spring Corp., Detroit, has been elected to receive the highest award for technical achievement conferred by the American Society for Metals. This is the Albert Sauveur Achievement Award established in 1934 to perpetuate the memory of Albert Sauveur, famed Harvard professor.

Mr. Zimmerli will receive this honor in recognition of his basic research in the field of shot-peening to increase favorable stresses in the surfaces of metal parts. "About 20 years ago", the citation that will accompany the plaque states in part, "F. P. Zimmerli conceived the idea that shot-peening could be used to advantage to increase the fatigue life of springs, and in 1929 the company with which he is associated shipped springs so created. This is the earliest record of such production and marks the beginning of an industry-wide development, as well as an important new approach to the understanding and solution of problems of endurance in allied fields of metallurgical engineering. . . . Much of the knowledge we now have on the subject of surface stress is dependent on extension of the original work, but is nonetheless based on Zimmerli's early investigations."

F. P. Zimmerli

The purpose of the Sauveur Award is to recognize a metallurgical achievement which has stimulated other organized work along similar lines to such an extent that a marked basic advance has been made in metallurgical knowledge. Award of the scroll and plaque will be made in Chicago on Oct. 23 at the annual banquet of the American Society for Metals, held during the National Metal Congress and Exposition.

Mr. Zimmerli has been with Barnes-Gibson-Raymond for the past 20 years. He received the degrees of B.S.E. (1917), M.S.E. (1918), and Metallurgical Engineer (1934) from the University of Michigan, where he is a former instructor. Before joining his present company, he was employed by the Solvay Process Co., Dodge Brothers and the Rickenbacker Motor Co.

Loan Scholarships Adopted By Notre Dame Chapter

A plan for establishing loan scholarships in metallurgy has been adopted by the Notre Dame Chapter ⓐ. The program will open with two scholarships of $250 each to be made available for the year beginning in September 1947 to undergraduate students majoring in metallurgy in the University of Notre Dame.

These loans are to be repaid to the chapter as soon as possible after graduation and will bear interest at the rate of 1% beginning on the date of graduation. They will be made on the basis of need and ability to those who have creditably completed at least the first four semesters of the curriculum in metallurgy.

The scholarships are to be bestowed annually, and in future years their number may be increased or decreased according to prevailing conditions.

The Reviewing Stand

LAST MONTH in this column we listed some questions asked in a poll of *Metals Review* readers some months ago. The answers were most gratifying, percentage-wise, and might have engendered a false sense of security had we not—unfortunately for our peace of mind—asked for comments and suggestions.

It was simple enough, of course, to analyze the questions merely by adding up the yeses and noes; when we finally totted up the tally sheets and put away the adding machine, we might well have cheered, relaxed, and said, "As long as we are pleasing some 90% of our readers, that's about the best that can be expected. Might as well just keep on the way we're going." . . . But there were still those pesky suggestions.

So the questionnaires were again sorted, classified, re-sorted, the classifications boiled down, and in the end we were able to list eight suggestions that turned up again and again. These are listed below in the order of frequency of occurrence.

1. More detailed abstracts in the Metal Literature Review.
2. Smaller page size (8½x11 most popular).
3. Print literature review on one side of page only, to facilitate clipping and filing.
4. Continue reports of lectures and meetings.
5. Use better paper.
6. Extend coverage of foreign publications.
7. New products descriptions should be more complete and accurate.
8. Better indexing and classification of literature annotations.

Some of these suggestions were fairly simple to put into operation; one has still to be translated into action; others required months of careful thought, planning, conferences, hatching of numerous schemes and ideas, all mulled over, discarded, resurrected, revised, and tried. The result was a new *Metals Review* introduced last January—different from its predecessors in appearance, style and content.

Numbers 2 and 3—smaller page size and one side of page—were definite and concrete; they required only a change in format, some consultations with the printer, and by the exercise of a little ingenuity it was found that they could be put into effect with little increase in expense or operating difficulty.

Number 5—better paper—unfortunately must wait yet a while longer. So extensive have the publications of the American Society for Metals grown that buying of paper is still a nip-and-tuck proposition. The paper makers are hounded and the books eventually get printed, but *Metals Review*, with its 22,000 monthly run, must still await a happier day.

Number 4—continued lecture and meeting reports—appeared merely to reflect a worry that new features might be added and expanded at the expense of space devoted to reports of lectures. These reports have been the backbone of *Metals Review* for 17 years; they will doubtless continue to be for the next 17 and then some, and no change in this editorial policy was contemplated.

But the ticklish ones were suggestions Nos. 1, 6, 7 and 8. What was done about them, and why, and how, we will tell you next month.

M. R. H.

and thermal insulation are sufficiently high so that it may be used with accuracy for measurements of very small quantities of heat; third, it does not call for expensive temperature and electrical-power measuring equipment. The development of specific-heat standards of Al_2O_3 in the form of corundum, for high-temperature calorimetry.

11-82. A New Method for Making Rapid and Accurate Estimates of Grain Size. Frederick C. Hull. *Metals Technology*, v. 14, June 1947, T.P. 2160, 13 p.

Improved method for determining grain size of metals or alloys. It is based upon a comparison of the image of the sample on the ground-glass plate of a metallograph with a grain-size standard transparency illuminated by transmitted light.

11-83. The Factorial Experiment in Engineering Research. M. K. Barnett. *Metals Technology*, v. 14, June 1947, T.P. 2161, 12 p.

A technique for obtaining the maximum amount of useful information relating to the influence of various factors on a given property, for a minimum expenditure of time and effort. The usual practice of studying one variable at a time, while holding all others constant, is not followed. A factorial arrangement of experiments is productive of a greater amount of information for a given number of experiments. This conclusion is amply illustrated by means of several examples from metallurgical research. However, the treatment is equally applicable to all types of research.

11-84. Identification of CaO-MgO Orthosilicate Crystals, Including Merwinite ($3CaO \cdot MgO \cdot 2SiO_2$), Through the Use of Etched Polished Sections. R. B. Snow. *Metals Technology*, v. 14, June 1947, T.P. 2167, 15 p.

A technique for polishing and etching specimens of openhearth furnace slags or hearth aggregates for identification of the crystalline constituents. This method does not require the use of the petrographic microscope.

11-85. Surface Finish Measurement Instrumentation. James A. Broadston. *Instruments*, v. 20, June 1947, p. 570-572.

Requirements and problems involved.

11-86. Producing High Purity Metals With Vacuum. J. D. Nisbet. *Iron Age*, v. 159, June 19, 1947, p. 56-59.

Vacuum melting system in which a centrifugal-casting operation is performed, and in which an arrangement is provided for loading and making additions to the furnace without disturbing the vacuum. The step-by-step procedure in producing a 6-lb. "ingot" under less than 50 microns pressure, together with precautions to be observed.

11-87. Metals Through the Microscope. Peter R. Lewis. *Scientific American*, July 1947, p. 24-25.

Technique and applications of photomicrography.

11-88. A New Electron Microscope With Continuously Variable Magnification. J. B. le Poole. *Philips Technical Review*, v. 9, no. 2, 1947, p. 33-45.

The principle of the electron microscope with particular reference to the focusing of electron beams by magnetic lenses. Description of a new electron microscope now in use at the Institute for Electron Microscopy at Delft. The resolving power amounts to about 25A and the magnification is continuously variable from 1000 to 80,000.

11-89. A Note on the Effect at the Cathode of an Arc Between Copper Electrodes. Maurice Milbourn. *Proceedings of the Physical Society*, v. 59, March 1, 1947, p. 273-275.

Observations on burning arcs and on arced electrodes indicate that melting of a copper cathode does not necessarily take place, and that selective distillation of impurities occurs when melting is induced by the presence of a metal having powerful reducing properties. Volatilization of copper from the cathode appears to be effected through the formation of cuprous oxide.

11-90. A Simple Technique for the X-Ray Determination of Fiber-Axes in Electrodeposited Metals. M. R. J. Wyllie. *Review of Scientific Instruments*, v. 18, June 1947, p. 425-429.

A special camera designed for the above. A method of computing the numerical value of the fiber-axis of the oriented crystals from simple linear measurements on the films obtained using this camera.

11-91. Measurement of Depth of Cold Work on X-Ray Spectrometer. Michael Field. *Review of Scientific Instruments*, v. 18, June 1947, p. 451-453.

Technique developed.

11-92. The Preservation of Metallurgical Microspecimens. Henry Thompson. *Metallurgia*, v. 36, June 1947, p. 96.

Use of transparent resinous coatings.

11-93. Apparatus for Measuring Power Loss in Small Ferromagnetic Samples Subject to an Alternating Magnetic Field. K. H. Stewart. *Journal of Scientific Instruments*, v. 24, June 1947, p. 159-162.

Apparatus enables loss measurements to be made at known flux densities on flat strip specimens, about 15x1x0.03 cm., of soft magnetic materials such as transformer sheet steel.

11-94. A Laboratory Testing Machine for Helical Gear Tooth Action. Harry Walker. *Engineer*, v. 183, June 6, 1947, p. 486-488.

Details of construction, operation, and typical test results.

11-95. Applications of High Vacuum Equipment. *Machinery Lloyd (Overseas Edition)*, v. 19, June 21, 1947, p. 90-93.

Applications and equipment in a variety of fields. An important and comparatively recent development is cathodic sputtering and evaporation for deposition of metals on miscellaneous nonmetallic materials.

11-96. How to Measure Surface Roughness of Castings. G. Hobman. *American Machinist*, v. 91, July 3, 1947, p. 94-95.

A simple instrument of the stylus type.

11-97. Controlling Casting Quality With a Dilatometer. Carl M. King. *Iron Age*, v. 160, July 3, 1947, p. 73-74.

How it assists foundryman in maintaining quality control by analyzing behavior of sand mixtures.

11-98. A Cathode-Ray B-H Tracer. Joseph Zamsky. *Electrical Engineering*, v. 66, July 1947, p. 678-680.

How the cathode-ray oscilloscope and associated equipment can be used for quantitative determination of magnetic properties without compensation for end effects. This equipment provides a method not only for obtaining core loss and permeability, but also for obtaining retentivity, coercive force, and degree of saturation of the test specimen.

11-99. Design of an Automatic Recording Dilatometer. Emerson S. Norris. *Electrical Manufacturing*, v. 40, July 1947, p. 106-107, 194, 196.

Instrument was developed for use in studying thermal-dilation rates of various materials. Electronic switching is used to control synchronous motor driving a recording potentiometer in place of usual time-drive.

11-100. High-Temperature X-Ray Diffraction. *Iron Age*, v. 160, July 10, 1947, p. 51, 128.

New equipment, using a Norelco X-ray spectrometer in which a Geiger counter replaces the photographic film, may be used to obtain patterns at temperatures up to 2700° F.

For additional annotations indexed in other sections, see:
4-76; 21-62; 27-130.

12 INSPECTION AND STANDARDIZATION

12-108. Supersonic Testing Detects Flaws in Metal Ten Feet Deep. John G. Smack. *Industry and Power*, v. 52, June 1947, p. 80-83, 112, 114, 116, 118.

Equipment used and case histories.

12-109. Inspection of Exposure Test Panels With Anodic Electrodeposited Coatings. Gustaf Soderberg. *American Society for Testing Materials, Preprint 40*, 1947, 6 p.

Inspection of electrodeposited coatings of zinc and cadmium on steel, exposed out-of-doors. It is believed that other nondecorative anodic coatings behave in the same general manner, and that the same general principles of inspection and evaluation will apply to them. 11 ref.

12-110. Radiographic Specifications, Their Nature, Purpose, and Current Revisions. J. J. Pierce. *Industrial Radiography & Non-Destructive Testing*, v. 5, Spring 1947, p. 21-23, 50.

12-111. Radiography of Radioactive Heavy Metals. Gerold H. Tenney. *Industrial Radiography & Non-Destructive Testing*, v. 5, Spring 1947, p. 33-36.

Method developed at Los Alamos for the radiography of uranium. A resolution of 2½% was achieved up to a thickness of 4 in.

12-112. Use of Magnaflux and Zyglo for Nondestructive Testing. K. E. Glover. *Industrial Radiography & Non-Destructive Testing*, v. 5, Spring 1947, p. 41-44.

Methods of applying tests and advantages of each.

12-113. Screening Vs. Sampling in Inspection. Philip G. Fishback. *Tool Engineer*, v. 18, June 1947, p. 18-23.

Advantages and disadvantages of various procedures.

12-114. Mechanical Testing. Part I. Laboratory Organization and Equipment. E. R. Arbon. *Aircraft Production*, v. 9, June 1947, p. 209-212.

Suggestions for improving efficiency.

12-115. Testing Spot Welds. A. M. Armour. *Aircraft Production*, v. 9, June 1947, p. 233-235.

New nondestructive technique for stainless steel which utilizes the change in magnetic permeability caused by welding. A good weld causes a large change, while a bad one does not. A transparent plastic cell containing minute magnetic particles suspended in light oil is used as the test device. On placing the cell on a sheet containing a good spot weld, the magnetized particles form a typical pattern.

12-116. Quality Control and Inspection of Welds. Gilbert C. Close. *Steel Processing*, v. 33, June 1947, p. 350-354.

Design considerations and stress relief by cold working.

12-117. German Radiographic Practices. Herbert R. Isenburger. *Metal Progress*, v. 51, June 1947, p. 961.

Comments critically on three O.T.S. reports on the above.

12-118. Spot Weld Analyzer for Maintenance Work. D. F. Hays. *Iron Age*, v. 159, June 12, 1947, p. 49-51.

An instrument possessing laboratory accuracy, yet easily operated by maintenance men.

12-119. Calculating Commercial Tolerances for Impression Die Forgings. *Iron Age*, v. 159, June 12, 1947, p. 57.

Determined by use of the chart presented.

(Turn to page 26)

Tentative Technical Program and Preprint List

List of Technical Papers to Be Presented Before the American Society for Metals at the National Metal Congress and Exposition, Chicago, Oct. 18 Through 24, 1947

Monday, Oct. 20—10:00 A.M.

An Investigation of Tempered Chromium-Silicon Spring Steel, by H. J. Elmendorf, American Steel & Wire Co. *(Preprint No. 1)*

The Effect of Carbon Content on the Hardenability of Boron Steels, by G. D. Rahrer and C. S. Armstrong, Carnegie-Illinois Steel Corp. *(Preprint No. 2)*

Tempering Effects and the Mechanical Equation of State, by J. C. Fisher and C. W. MacGregor, Massachusetts Institute of Technology *(Preprint No. 3)*

Monday, Oct. 20—2:00 P.M.

The Induction Hardening of a Quality Controlled Cast Iron, by C. F. Walton, Meehanite Metal Corp. and H. B. Osborn, Jr., Ohio Crankshaft Co. *(Preprint No. 4)*

Some Factors Affecting the Induction Hardening of an Alloy Cast Iron, by J. R. Sloan and R. H. Hays, Caterpillar Tractor Co. *(Preprint No. 5)*

A Study of the Metallurgical Characteristics of Three Induction-Hardened Steels Heated at Various Rates, by James W. Poynter, Wright Field *(Preprint No. 6)*

Tuesday, Oct. 21—10:00 A.M.

Session No. 1

The Dimensional Stability of Steel—Part II—Further Experiments on Subatmospheric Transformations, by S. G. Fletcher, Latrobe Electric Steel Co., and B. L. Averbach and M. Cohen, Massachusetts Institute of Technology *(Preprint No. 7)*

The Dimensional Stability of Steel—Part III—Decomposition of Martensite and Austenite at Room Temperature, by B. L. Averbach and M. Cohen, Massachusetts Institute of Technology, and S. G. Fletcher, Latrobe Electric Steel Co. *(Preprint No. 8)*

Acicular Transformations in Alloy Steel, by E. A. Loria, Mellon Institute of Industrial Research *(Preprint No. 9)*

Session No. 2

Beryllium in Magnesium Casting Alloys, by Jay R. Burns, Wright Field *(Preprint No. 10)*

The Heat Treatment and Properties of Some Beryllium-Nickel Alloys, by W. Lee Williams, U. S. Naval Engineering Experiment Station *(Preprint No. 11)*

Stretching Characteristics of Aluminum Alloy Sheet, by J. M. Taub, Los Alamos Scientific Laboratory *(Preprint No. 12)*

Tuesday, Oct. 21—2:00 P.M.

The Location of Alloying Metals in White Cast Iron, by H. A. Schwartz and James Hedberg, National Malleable & Steel Castings Co. *(Preprint No. 13)*

All of the papers presented at the Annual Convention of the American Society for Metals in Chicago, Oct. 20 through 24, will be preprinted for distribution to members of the A.S.M. The society will print only 10% in excess of the number of orders for preprints in the office on press date and this excess 10% will be sent out as long as it lasts. Please order only those preprints in which you are immediately interested because all papers listed for presentation will be printed, together with discussion, in future *Transactions.* Order by number from this list before Sept. 10, 1947.

Graphitization of Steel at Elevated Temperatures, by A. B. Wilder and J. D. Tyson, National Tube Co. *(Preprint No. 14)*

Concept of the Hydrogen Potential in Steam-Metal Reactions, by Carl A. Zapffe, Baltimore *(Preprint No. 15)*

Wednesday, Oct. 22—10:00 A.M.

ASM Annual Meeting

Edward de Mille Campbell Memorial Lecture, by A. B. Kinzel, Electro Metallurgical Co.

Wednesday, Oct. 22—2:00 P.M.

Cast Heat Resistant Alloys of the 26% Cr, 20% Ni Type—I, by H. S. Avery and C. R. Wilks, American Brake Shoe Co. *(Preprint No. 16)*

The Cobalt-Chromium J Alloy at 1350 to 1800° F, by N. J. Grant, Massachusetts Institute of Technology *(Preprint No. 17)*

Metallography of Hot-Dipped Galvanized Coatings, by D. H. Rowland, Carnegie-Illinois Steel Corp. *(Preprint No. 18)*

Thursday, Oct. 23—10:00 A.M.

Mechanical Properties of Metals at Low Temperatures; A Survey, by L. Seigle and R. M. Brick, University of Pennsylvania *(Preprint No. 19)*

Influence of Metallurgical Factors on the Mechanical Properties of Steel, by S. A. Herres and C. H. Lorig, Battelle Memorial Institute *(Preprint No. 20)*

The Fatigue Strength of Binary Ferrites, by E. Epremian, General Electric Co., and E. F. Nippes, Rensselaer Polytechnic Institute *(Preprint No. 21)*

Thursday, Oct. 23—2:00 P.M.

The Bend Test for Hardened High Speed Steel, by A. H. Grobe and G. A. Roberts, Vanadium-Alloys Steel Co. *(Preprint No. 22)*

Effects of Grinding on Physical Properties of Hardened Steel Parts, by H. E. Boyer, American Bosch Corp. *(Preprint No. 23)*

Recrystallization as a Measurement of Relative Shot Peening Intensities, by K. B. Valentine, Pontiac Motor Div., General Motors Corp. *(Preprint No. 24)*

Friday, Oct. 24—10:00 A.M.

Macro-Segregation in Some Alloy Steel Ingots, by J. W. Spretnak, Carnegie Institute of Technology *(Preprint No. 25)*

The Distribution of Oxygen and Nitrogen in an Alloy Steel Ingot, by C. F. Sawyer, J. W. Spretnak and G. Derge, Carnegie Institute of Technology *(Preprint No. 26)*

Multiple Correlation Applied to Steel Plant Problems, by W. T. Rogers, National Tube Co. *(Preprint No. 27)*

Friday, Oct. 24—2:00 P.M.

Detection of As-Cast Austenite Grain Size in Heat Treated Cast Alloy Steels, by E. A. Loria, Mellon Institute of Industrial Research *(Preprint No. 28)*

The Effect of Silicon on the Properties of Cast Carbon and Carbon-Molybdenum Steels, by N. A. Ziegler, W. L. Meinhart and J. R. Goldsmith, Crane Co. *(Preprint No. 29)*

The Effect of Homogenization on Cast Steels, by R. J. Marcotte and C. T. Eddy, Michigan College of Mining and Technology *(Preprint No. 30)*

Lecture Courses—Not Preprinted

Introductory Physical Metallurgy

Four Lectures by C. W. Mason, Cornell University. Monday and Tuesday, Oct. 20 and 21, both days at 4:15 and 8:00 P. M.

Copper and Copper Alloys

Three Lectures by O. W. Ellis, Ontario Research Foundation. Wednesday, Oct. 22, 4:15 and 8:00 P. M.; Thursday, Oct. 23, 4:15 P. M.

12-120. A.S.T.M. Specifications for Electrodeposited Coatings. *Automotive and Aviation Industries*, v. 96, June 15, 1947, p. 36-37.

Specifications given cover minimum thickness requirements for electroplated coatings on significant surfaces of finished articles of steel, copper and copper-base alloys, and zinc and zinc-base alloys.

12-121. Small Parts Inspection by Automatic Gaging. C. W. Warren. *Iron Age*, v. 159, June 19, 1947, p. 64-65.

A new type of gaging system known as Limitron. This instrument is completely automatic and is suitable for use by blind, partially deaf, or otherwise disabled personnel with little training.

12-122. A Large Cylinder and Taper Comparator for Gage Measurement. R. H. Field. *Canadian Journal of Research*, v. 25, Section F, May 1947, p. 238-241.

Comparator for accommodating cylinders or cones with maximum diameters of 12 in. and lengths up to 48 in. Special consideration given to ease of construction; no ultra-precision grinding or difficult fits involved.

12-123. An Improved Interferometer for Determining Parallelism Errors in Long End-Gages. L. Graham Turnbull. *Canadian Journal of Research*, v. 25, Section F, May 1947, p. 242-255.

An interferometer determines parallelism of the working faces of end-gages up to 24 in. in length. This new interferometer incorporates kinematic principles and a number of interesting features to permit easy adjustment and operation to the very fine limits necessary. Differences in length of nominally equal end-gages can be determined to an accuracy of 1 or 2 $\times 10^{-6}$ in.

12-124. Radiographic Quality Control in Aluminum Die Casting. R. W. Dively. *Light Metal Age*, v. 5, June 1947, p. 14-15.

Techniques followed at the Hoover Co.

12-125. Standard Type Numbers, Chemical Composition Limits and Ranges for Stainless Steels. *Materials & Methods*, v. 25, June 1947, p. 123.

Revised compositions approved by the American Iron & Steel Institute, April 16, 1947.

12-126. Tolerances for Impression Die Forgings. *Materials & Methods*, v. 25, June 1947, p. 125.

Use of chart is illustrated by two examples.

12-127. Radiography as a Control for Welding Joints in Pipe Lines. Russell G. Rhoades. *Welding Journal*, v. 26, June 1947, p. 497-498.

How it may be applied to field operations; faults to be watched for; techniques to be followed; advantages over other systems of inspection.

12-128. Angular Tolerances of Taper Plug and Ring Gages. W. Richards. *Machinery (London)*, v. 70, June 5, 1947, p. 589-591.

Details of calculation and effect of angular tolerances by diagrams.

12-129. Importance of Radiography in Inspection. E. L. LaGrelius. *Foundry Trade Journal*, v. 82, June 12, 1947, p. 139-140.

Paper read before 1947 Conference of American Foundrymen's Assoc.

12-130. Product Quality Specifications. F. E. Powell. *American Ceramic Society Bulletin*, v. 26, June 15, 1947, p. 181-183.

Bases and functions of standards and specifications. Mechanics of establishing commercial standards through the Division of Trade Standards of the National Bureau of Standards.

12-131. Report of Committee on Wheels. E. E. Chapman. *Railway Age*, v. 122, June 28, 1947, p. 1294D184-1294D188.

Recommendation to increase strength of rims of the 700-lb. chilled-iron wheel by adding ⅛ in. of metal to the underside of the rim and making other minor changes; specifications for location of Brinell hardness checks; changes in specifications in standard and tubular axles when used with roller bearings.

12-132. Specifications for Materials. T. D. Sedwick. *Railway Age*, v. 122, June 27, 1947, p. 1294D229-1294D230.

Committee report proposes new limits for copper content of firebox steel. Subcommittee studies effect of residual alloys and aging of synthetic rubber.

12-133. Electro-Mechanical Gaging. *Product Engineering*, v. 18, July 1947, p. 102-103.

Details of the Limitron, produced by Arma Co., Brooklyn, which combines mechanical gaging with electrical measuring and sorting to overcome the weaknesses in either system.

12-134. Scale Diagram for Relations of Thread Dimensions. John L. Skeehan. *Product Engineering*, v. 18, July 1947, p. 175.

The relations, allowances, and tolerances for pitch diameters of class 1, 2, 3, and 4 fits for a 1-in. diameter, 8-thread bolt-and-nut combination.

12-135. New Plug Gage Simplifies Gaging Operation. *Machine and Tool Blue Book*, v. 43, July 1947, p. 174-176, 178, 180, 182, 184, 186, 188.

Construction of a new plug gage and its application in inspection procedure.

12-136. Precision Measurement. Section II. Instrument Inspection; Part XII. Inspection of Plug and Ring Gages; Introduction to Thread Measurement. Warren Baker. *Machine and Tool Blue Book*, v. 43, July 1947, p. 212-216, 218-220, 222-225.

12-137. Nondestructive Inspection. R. W. Dively. *Die Castings*, v. 5, July 1947, p. 56-60.

Use of radiography for testing die castings for internal defects.

12-138. How to Increase Tolerances and Obtain Closer Fits. Edmond E. Bates. *Iron Age*, v. 160, July 3, 1947, p. 58-61.

Taking as an example a precision part on which rejections ran up to 40%, the author shows how statistical control was applied to eliminate scrap, by increasing tolerances while simultaneously improving the quality of the fit.

12-139. End Product Improved by Quality Controlled Methods. *Production Engineering & Management*, v. 20, July 1947, p. 66-74.

Precision forming and machining operations in production of Argus cameras.

12-140. Quality Control. An Important Factor in Competitive Production. Jerome R. Steen. *Steel*, v. 121, July 7, 1947, p. 89, 126, 129.

Its application in production of coated cathodes by Sylvania Electric Products.

For additional annotations indexed in other sections, see:

6-161; 7-257; 20-367; 21-61; 22-321-358; 27-118-129-145-146.

13 PYROMETRY Temperature Control

13-30. Liquid Steel Streams. J. A. Hall. *Iron and Steel*, v. 20, May 23, 1947, p. 218-228; discussion, p. 290-291.

Results of a photographic investigation of brightness temperatures. 23 ref.

13-31. Platinum Thermocouples. *Iron and Steel*, v. 20, May 23, 1947, p. 232-240.

Symposium on their contamination. Embrittlement of Pt-Rh wire in the heads of liquid-steel pyrometers, by T. Land. Fracture of Pt-13% Rh wires used in the immersion thermocouple, by L. Reeve and A. Howard. X-ray investigations, by H. J. Goldschmidt and T. Land. Contamination and failure of rare-metal thermocouples, by D. Manterfield. Embrittlement of Pt and Pt-Rh thermocouples, by J. C. Chaston, R. A. Edwards, and F. M. Lever. Examination of the microstructure of contaminated and embrittled Pt and Pt-Rh wires, by R. C. Jewell.

13-32. Heating and Melting Furnace Controls. C. G. Bigelow, Jr. *Iron and Steel Engineer*, v. 24, June 1947, p. 44-49; discussion, p. 49.

The costs of the various types of controls, and evaluation of their economic advantages. A calculation based on estimates shows savings of almost $10,000 per year for a 40-ton continuous furnace.

13-33. Temperature Scale of the Blowing-Tube Bath Pyrometer. L. O. Sordahl and J. W. Bain. *Iron and Steel Engineer*, v. 24, June 1947, p. 60.

Condensation of paper presented before American Institute of Mining and Metallurgical Engineers, Cincinnati, Ohio, April 21 to 23, 1947.

13-34. Closer Control of Blast Furnaces Through Increased Instrumentation. *Industrial Heating*, v. 14, June 1947, p. 954, 956, 958, 960.

Possibilities of more closely controlling blast furnaces through increased instrumentation.

13-35. Instrumentation. *Iron and Steel*, v. 20, June 1947, p. 310.

Open-Hearth Instruments Sub-Committee of Steelmaking Div. of British Iron and Steel Research Assoc. gives recommendations for openhearth furnaces.

13-36. How to Select and Install Pyrometer Leadwires. C. C. Roberts and C. A. Vogelsang. *Power*, v. 91, July 1947, p. 69-71, 150, 152.

13-37. Accurate Control Spells Success in Heat Treating. C. C. Roberts. *American Machinist*, v. 91, July 17, 1947, p. 139-140.

Control instruments for salt-bath furnaces operated on various heat treatments.

14 FOUNDRY PRACTICE

14-170. Semicontinuous Casting. H. Hocking. *Metal Industry*, v. 70, May 9, 1947, p. 342.

Use of the semicontinuous casting machine to attain and maintain an improved quality material coupled with an increased rate of production.

14-171. Application of Hydro-Blast to Dressing and Sand Recovery. Part II. Wm. Y. Buchanan. *Foundry Trade Journal*, v. 82, May 29, 1947, p. 91-95; discussion, p. 96.

Test results using the Hydro-Blast process for preparation of foundry sands. (Paper read before the Scottish branch of the Institute of British Foundrymen, Royal Technical College, Glasgow.)

14-172. Core Operating Devices for Die Casting Dies. N. Field. *Machinery (London)*, v. 70, May 29, 1947, p. 576-579.

Design details of mechanical devices for withdrawal of cores.

14-173. Dies for Radio Casing. *Machinery (London)*, v. 70, May 29, 1947, p. 579.

Dies for part which is pressure cast in aluminum alloy.

14-174. Light-Alloy Castings. J. A. Oates. *Aircraft Production*, v. 9, June 1947, p. 218-223.

Production of aircraft pistons and

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New Officers of the Dayton Chapter Are (Left to Right): J. J. Niehaus, Treasurer; Roger W. Edmonson, Retiring Chairman; Stewart M. DePoy, Chairman; J. D. Loveley, Vice-Chairman; and C. L. Gillum, Secretary

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other components by Wellworthy Piston Rings, Ltd., including casting and machining methods.

14-175. Cadillac's Modernized Foundry Facilities. Joseph Geschelin. *Automotive and Aviation Industries*, v. 96, June 15, 1947, p. 24-27, 72.

Is highly mechanized and provided with latest types of equipment.

14-176. How to Make Precision Castings. James Van Voast. *American Machinist*, v. 91, June 19, 1947, p. 125-140.

Design, production, and applications.

14-177. When Metal Atoms Wander. Edwin Laird Cady. *Scientific American*, July 1947, p. 15-17.

Use of heat and pressure in pressure casting and compression welding.

14-178. Electronic Core Baking. R. W. Crannell. *Foundry*, v. 75, July 1947, p. 66-69, 240-241.

Development work conducted at Lehigh Foundries, Inc., during the past year.

14-179. A Study of the Behavior of Molding Sand When in Contact With Liquid Steel. J. B. Caine. *Foundry*, v. 75, July 1947, p. 72-77, 143, 146, 149, 153, 155-156, 158.

Simple procedure used for an extensive investigation of the effects of various factors on the above. Over 5000 tests were made. The effects of ramming procedure, air drying, water content, new sand vs. reclaimed sand, green sand vs. air-dried sand, and of various organic binders.

14-180. New Automotive Foundry Engineered on Assembly Line Pattern. *Foundry*, v. 75, July 1947, p. 80-85, 240.

Procedures in Cadillac's new foundry.

14-181. Plastic Patterns. Robert H. Herrmann. *Foundry*, v. 75, July 1947, p. 89, 232-233.

Advantages and techniques for use of plastic patterns of phenol-formaldehyde resin.

14-182. A.F.A. Sessions Detail Casting Developments. *Foundry*, v. 75, July 1947, p. 96-97, 122, 125-126, 128.

Concludes report on the technical papers and discussions at the recent annual meting of A.F.A. in Detroit.

14-183. High Production of Carburetor Die Castings. Herbert Chase. *Machinery*, v. 53, July 1947, p. 158-163.

Die casting, chromate treating, and machining operations performed in producing 2600 zinc alloy carburetors a day. (To be continued.)

14-184. Foundry Grinding Wheels. Carl A. Carlson. *American Foundryman*, v. 11, June 1947, p. 22-27.

Their manufacture and use.

14-185. Molding Sands. G. R. Gardner. *American Foundryman*, v. 11, June 1947, p. 34-38.

Method for accumulating data useful in defining the range of values over which mold properties may extend.

14-186. New Process Chemically Treats Molding Sand. Thomas W. Curry. *American Foundryman*, v. 11, June 1947, p. 50-56.

Initial operation consists of coating the sand grain with a micro-thin film of a high carbon resin. This is accomplished by mixing a washed and damp silica sand with a proportionate amount of the water-soluble chemical in the ordinary foundry mixer. The mixture is then passed through a rotary drier at 300 to 350° F., to evaporate the solvent and water vapor and set the coating on the grain. The coated sand in then introduced to the molding unit, where it is subsequently mixed with bentonite, cereal, the water-soluble chemical, and water.

14-187. Gates and Risers. Nathan Janco. *American Foundryman*, v. 11, June 1947, p. 57-60.

Details of the calculation of sizes for centrifugal casting.

14-188. Cupola Operation. Walter Chretien-Hersand. *Iron and Steel*, v. 20, June 1947, p. 306.

Swiss foundry manager presents empirical calculations for determining amounts of Si, P, S, and Mn upon repeated remelting. Factors affecting carbon content upon remelting.

14-189. Spark Arresters. J. H. List. *Iron and Steel*, v. 20, June 1947, p. 314.

Interesting new design for two-cupola operation.

14-190. Gases Given Off by Core Binders. Hiram Brown. *Light Metal Age*, v. 5, June 1947, p. 10-13.

Experimental data for 17 core oils with linseed oil, mineral oil, urea resin and cereal flour as bases. Also gives ratio of strength to gas content of binders.

14-191. Progress in Casting. A Review of American Foundry Practice. *Metallurgia*, v. 36, June 1947, p. 97-99.

Papers by six experts from Battelle Memorial Institute dealing with developments in gray iron, malleable iron, steel, brass and bronze, aluminum, and magnesium castings, are briefly reviewed. (The papers were originally published in *Foundry*, v. 74, no. 1, 1946, p. 70-103.)

14-192. Some Molding Problems and Their Solutions. S. Jane. *Foundry Trade Journal*, v. 82, June 5, 1947, p. 113-115, 118.

How the following problems were solved: a frame 9 ft. square and curved on the base to fit a shell 13 ft. 6 in. in diameter; a truck wheel with lugs; and a complex part called a "tank spare." (From a paper read before the South African Branch of the Institute of British Foundrymen.)

14-193. German Spun Cylinder Liners. *Foundry Trade Journal*, v. 82, June 5, 1947, p. 119-120, 122.

Machine design; foundry technique; charging equipment; mold dressing; and sand practice. (Abstracted from B.I.O.S. Report No. 700.)

14-194. Considerations in the Purchase of Patterns. W. G. Schuller. *Foundry Trade Journal*, v. 82, June 5, 1947, p. 123-124.

Factors leading to cost reduction and a uniformly good product. (Paper presented to Annual Meeting of A.F.A.)

14-195. Centrifugal Casting. Jhan Van Hiel. *Western Machinery and Steel World*, v. 38, June 1947, p. 98-101.

Process, especially as conducted at the Torrance Brass Foundry, Torrance, Calif.

14-196. Again—East Comes West. *Western Machinery and Steel World*, v. 38, June 1947, p. 112-114.

Operations at Howard Foundry Co. in casting of ferrous and nonferrous metals.

14-197. Effect of Sand Properties Upon Castings. N. J. Dunbeck. *Canadian Metals & Metallurgical Industries*, v. 10, June 1947, p. 22-26, 35, 43.

The effect of molding materials other than sand. The effects of green strength, dry and hot strength, permeability, moisture content, flowability, mold hardness, deformation (toughness), expansion, refractory value and sintering point, collapsibility, and durability. Effect of additions of sea coal, pitch, cereal and resin binders, wood flour, fuel oil, silica flour, and iron oxide, to the sand for castings.

14-198. Cellulose Derivatives as Core Binders in German Foundries. O. R. J. Lee. *Foundry Trade Journal*, v. 82, June 12, 1947, p. 135-136.

Experimental results.

14-199. Additions to Metal Coreboxes. *Foundry Trade Journal*, v. 82, June 12, 1947, p. 145.

Design improvements.

14-200. Core and Molding Sands for Aluminum Foundries. C. E. Heussner, Donald M. Bigge, Harvey J. Cole, Gordon Curtis, Harry Dietert, Robt. E. Schenck, and Norman Smith. *Modern Metals*, v. 3, June 1947, p. 21-25.

Sixth of a series dealing with aluminum-foundry practice describes molding sands, binders, sand testing, reprocessing molding sands, core sands and binders, core washes and sprays, inhibitors, core baking, reclamation of core sand, and various definitions for foundry-sand terms.

14-201. The Lost-Wax Process. H. Evans, P. S. Cotton, and J. Thexton. *Machinery (London)*, v. 70, June 19, 1947, p. 645-650.

Its application to the precision casting of nickel alloys.

14-202. Practical Procedures for Reducing Gas Porosity in Nonferrous Castings. A. E. St. John. *Iron Age*, v. 160, July 3, 1947, p. 46-48.

Recommended practices covering tin bronzes, the aluminum and silicon bronzes, the yellow brasses, and the manganese bronzes. Effects of fuel-fired and electric furnace melting. Atmosphere control, melting practice, superheating, stirring, deoxidizing, and pouring.

14-203. Centrifugal Casting. J. W. Moore and J. W. MacKay. *Mechanical Engineering*, v. 69, July 1947, p. 551-556.

The process as applied to stainless and carbon-steel tubes at American Cast Iron Pipe Co., Birmingham, Ala.

For additional annotations indexed in other sections, see:
3-191-192; 4-87; 11-97; 12-124-131-24-176; 27-121-133-149.

15 SALVAGE AND SECONDARY METALS

15-21. How to Reclaim Castings With Machinable Welds. David W. DeArmand and Samuel Epstein. *Industry and Welding*, v. 20, June 1947, p. 30-32.

Use of special flux-coated high-nickel-content electrodes.

15-22. Repair Procedures in a Production Weld Shop. Orlo E. Brown and Charles R. Causey. *Iron Age*, v. 159, June 19, 1947, p. 60-63.

Suggestions for setting up a system of work handling and for classifying types of repair work according to material. Repair of cast-iron parts; how to avoid cracking and distortion.

15-23. Furnace Converts Turnings Into Heavy Melting Stock. J. C. Sullivan. *Steel*, v. 120, June 23, 1947, p. 124, 127.

How turnings subjected to tumbling action under high temperature and controlled atmosphere are balled into compact mass.

15-24. Lime Treatment of Waste Pickle Liquor. C. J. Lewis. *Iron Age*, v. 159, June 26, 1947, p. 45-49.

Various factors which govern the selection of proper liming material, from the standpoint of chemical reactivity and economy. Methods of preparation and application to spent pickle liquor; several suggested techniques for sludge disposal.

15-25. Organization for Scrap Cutting. *Linde Tips*, v. 26, July 1947, p. 80-81.

Mechanized arrangement which saves time and labor.

For additional annotations indexed in other sections, see:
7-256-274; 8-104; 22-337-354.

16 FURNACES AND FUELS

16-83. Openhearth Furnaces. D. Kilby. *Iron and Steel*, v. 20, May 23, 1947, p. 209-214; discussion, p. 291-292.

Firing of openhearths with coke-

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NEW CHAPTER OFFICERS (*Cont.*)

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Secretary-Treasurer—G. W. Davison, National Supply Co., Toledo, Ohio.

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Vice-Chairman—M. C. Fetzer, Carpenter Steel Co., Reading, Pa.
Secretary-Treasurer—G. A. Barker, Bethlehem Steel Co., Bethlehem, Pa.

oven gas. Design factors, a description of a 100-ton furnace, fuel characteristics and consumption, furnace operation, and refractory consumption. Arrangement of water-cooled jacket and design of combined pitch-creosote and gas burner, and pitch-creosote atomizer.

16-84. Openhearth Furnace Combustion. Parts I and II. *Iron and Steel*, v. 20, May 23, 1947, p. 258-266.

An experimental furnace for the investigation of thermal problems. Description of plant, by A. H. Leckie, J. R. Hall, and C. Cartlidge. The effects of gas rate, port size, air-gas ratio, furnace pressure, and gas calorific value, by A. H. Leckie, J. F. Allen, and G. Fenton.

16-85. Use of Oxygen in Combination With Openhearth Furnace Fuel. *Industrial Heating*, v. 14, June 1947, p. 962, 964.

A discussion.

16-86. A New Principle in Induction Heating. Thomas E. Lloyd. *Iron Age*, v. 159, June 12, 1947, p. 46-48.

New type of induction-heating apparatus known as the "Gordon Trigaton". Among the features claimed for it are: constant work-coil power output; stepless power-output control; high operating efficiency with operating frequencies in the range of 500,000 cycles that can be adjusted upward or downward; unit part construction; and a quick, inexpensive work coil construction. The instrument used in converting 60-cycle energy into radio-frequency energy is a specially designed gaseous three-element tube.

16-87. Some Technical Aspects of Oil-Firing Industrial Furnaces. G. Reginald Bashforth. *Metallurgia*, v. 36, June 1947, p. 57-62.

The characteristics and properties of fuel oil, its advantages and disadvantages, storage and supply lines, atomization, burner and burner design, and control instruments. Brief reference is also made to the use of tar and tar oils.

16-88. Development of an Oil-Fired Pile-Heating Furnace for the Wrought Iron Industry. L. G. A. Leonard. *Metallurgia*, v. 36, June 1947, p. 95-96.

Furnace was specially designed for pile heating and is fired by oil. It has a thermal efficiency about three times that of the coal-fired furnace it replaced.

16-89. Reverberatory Furnace. *Metal Industry*, v. 70, June 13, 1947, p. 440.

British ½-ton oil-fired furnace for melting of aluminum alloys.

16-90. Controlling an Indirect-Arc Rocking Electric Furnace. *Electrical Manufacturing*, v. 40, July 1947, p. 108-109, 198.

Automatic rocking through variable angles up to 180° is accomplished with limit switches and relays, while automatic feed of the arc carbons is performed hydraulically under electric control.

For additional annotations indexed in other sections, see:

2-135; 6-149; 13-32-34; 15-23; 18-131.

17 REFRACTORIES Furnace Materials

17-61. A Note on the Application of the Differential Thermal Analysis Method to Some Basic Refractory Materials. T. W. Howie and J. R. Lakin. *Transactions of the British Ceramic Society*, v. 46, Jan.-Feb. 1947, p. 14-19; discussion, p. 19-22.

Application to magnesite, dolomite, and chromite products.

17-62. Alunite and Clays. J. O. Knizek and H. Fetter. *Transactions of the British Ceramic Society*, v. 46, Jan.-Feb. 1947, p. 22-46.

Results of an extensive investigation of Mexican refractory clays containing alunite and natro-alunite. Use of thermal analysis in detecting the presence of the alunites in clays. Study of firing behavior showed that suitable additions of alunite to clay improve the bond, and raise the temperature of the softening point. The apparent porosity of a clay-alunite mixture decreases as the concentration of alunite increases, and there is a corresponding increase in bulk density. 26 ref.

17-63. The Manufacture of Refractories and Information Concerning Their Use in the Iron and Steel Industry of Western Germany. *Refractories Journal*, v. 23, May 1947, p. 155-162.

Introductory article of series summarizes results of investigation of 14 German refractory plants and two steel plants. Refractories used at the Mannesmann Werke—blast furnaces, bessemer converters and openhearth furnaces. (Reprinted from F.I.A.T. Final Report No. 432.)

17-64. Various Refractory Subjects Highlight Present Problems at 49th American Ceramic Society Meeting. *Brick & Clay Record*, v. 110, June 1947, p. 64, 66, 68, 70, 72.

Abstracts of papers not included in May issue.

17-65. Development of Zirconia Resistant to Thermal Shock. Carl E. Curtis. *Journal of the American Ceramic Society*, v. 30, June 1, 1947, p. 180-196.

Effects on crystal stabilization and other properties of pure zirconia were determined for additions of CaO, MgO, BeO, ThO, and CeO in binary and ternary combinations. Several systems were found to produce complete stabilization. The discovery of such systems will allow use of zirconia for refractories in contact with molten metals and slags. Previously such use has been limited by its low resistance to thermal shock. 26 ref.

17-66. Report of Committee on Research. J. H. Koenig. *American Ceramic Society Bulletin*, v. 26, June 15, 1947, p. 192-198.

Research programs in refractories and whiteware sponsored by the U. S. Government and by private organizations. 20 ref.

18 HEAT TREATMENT

18-115. Tempering of Toolsteels. Part II. Morris Cohen. *Metal Progress*, v. 51, June 1947, p. 962-968.

Dimensional stability that results from the tempering.

18-116. A New Method of Coil Annealing. H. H. Armstrong and F. F. Schlitt. *Iron and Steel Engineer*, v. 24, June 1947, p. 35-39; discussion, p. 40-43.

Technique, which has been reduced to commercial practice, for edge heating of coils of strip steel or tin plate. A much better rate of heat transfer is provided than for penetration through the laminations.

18-117. Deformation of Machine Steel Rings During Casehardening. J. E. Erb. *Steel Processing*, v. 33, June 1947, p. 347-349.

Test results show stress relieving prior to casehardening has little effect on final deformation results, and a considerable amount of shrinkage takes place on quenching after casehardening of a steel containing 0.18% C, 0.40% Mn, 0.40% P, 0.05% S, and 0.25% Si.

18-118. The Relationship of the Growth Exhibited on Nitriding to the Microstructure of the Nitrided Specimen. Part III. Lester F. Spencer. *Steel Processing*, v. 33, June 1947, p. 362-367, 369-370, 372-373.

Results of size and hardness measurements before and after nitriding. Structural changes. 29 ref. (Concluded.)

18-119. Heat Treating Aircraft Blades Made From Steel Tubing at American Propeller Corp. *Industrial Heating*, v. 14, June 1947, p. 916-918, 920, 922, 924, 926, 928, 952.

The different steps in the fabrication of a blade, with special reference to the heating and heat treating operations involved.

18-120. Methods for the Quenching of Steel. Part VII. Flood Quenching and Surface Quenching. M. H. Mawhinney. *Industrial Heating*, v. 14, June 1947, p. 930, 932, 934, 936, 938.

Flood quenching; surface hardening. (Concluded.)

18-121. Induction Hardens Trick Machine-Tool Parts. *American Machinist*, v. 91, July 3, 1947, p. 89-92.

How initial applications at Jones & Lamson result in rerouting of more than 175 standard jobs, plus solutions of special problems.

18-122. Quenching Media and Methods. Harold L. Flynn. *American Machinist*, v. 91, July 3, 1947, p. 105-116.

Structural changes on quenching; quenching media; quenching methods; quenching equipment.

18-123. Logging Trailers That Can Take It. *Western Machinery and Steel World*, v. 38, June 1947, p. 110-111.

Setups for oxy-acetylene flame hardening of parts.

18-124. Two Opinions on Conditions for the Successful High-Frequency Hardening of Steel *Sheet Metal Industries*, v. 24, June 1947, p. 1196-1199.

Critical discussion by J. D. Jevons of article by R. J. Brown, in March and April issues. Author's reply.

18-125. Tool Steels. Part VI. L. Sanderson. *British Steelmaker*, v. 13, June 1947, p. 294-297.

Technology and applications of chromium-vanadium steels, and general recommendations for forging and heat treating of toolsteels. (To be continued.)

18-126. Aluminum Sand Casting Alloys. H. A. Quadt. *American Foundryman*, v. 11, June 1947, p. 39-43.

Effect of room temperature intervals between quenching and aging on properties. 12 ref.

18-127. Ingenious Steel Quenching Practices Developed by Farm Implement Makers. Kenneth Rose. *Materials & Methods*, v. 25, June 1947, p. 77-80.

Combination quenching-forming machines, rather complicated in design, which permit high production, close dimensional control, and other economies in heat treating.

18-128. What to Look for in the Metal Industries. O. E. Cullen. *Industrial Gas*, v. 25, June 1947, p. 15-16, 31-32.

Applications of prepared gas atmosphere.

18-129. Precipitation Hardening. Part III. L. Sanderson. *Chemical Age*, v. 56, June 7, 1947, p. 741-743.

Effect of precipitation hardening on aluminum alloys; procedures. (To be continued.)

18-130. The Dimensional Stability of a High-Duty Cast Iron. L. W. Nickols. *Machinery (London)*, v. 70, June 12, 1947, p. 623-624.

Ten bars were heat treated and annealed in different ways. Accurate length measurements were made each year for seven years.

18-131. Commercial Heat Treating Boosted by Centralized Furnaces. *Production Engineering & Management*, v. 20, July 1947, p. 60-62.

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NEW CHAPTER OFFICERS (*Cont.*)

Los Alamos Chapter

Chairman—James M. Taub, P. O. Box 1663, Los Alamos, N. M.
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Clyde Atchinson (Left), Retiring Chairman of Kansas City Chapter, Greets the New Chairman, Milo Stutzman

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Secretary—Joseph D. Allen, M. S. M. Apt. T-4, Rolla, Mo.
Treasurer—Roger E. Nowlin, 1108 Bishop, Rolla, Mo.

How excellent control of physical and metallurgical characteristics is obtained on intricate-shaped and odd-sized parts with salt-bath furnaces.

18-132. Longer Life for Wearing Surfaces. *Linde Tips*, v. 26, July 1947, p. 96-97.

Simple shot setup which flame hardens 350 tin-snip blades per hour.

18-133. Controlling Physical Properties by the Interrupted Quench. H. E. Boyer. *Iron Age*, v. 160, July 3, 1947, p. 49-54.

Three variations of interrupted quenching: austempering, martempering, and marquenching. Methods of varying martempering procedures whereby desired hardness and toughness properties can be predetermined, and its deformation characteristics as compared with conventional oil quenching methods. Data presented have been obtained primarily from S.A.E. 52100 steel, but principles can be applied to other types of steels with equally desirable results.

18-134. Gas Chemistry. Its Role in Metallurgy. O. E. Cullen. *Steel*, v. 121, July 7, 1947, p. 86-88, 120, 122, 124.

Carbon restoration, precise control of carbon-bearing gases for heat treatments, dry cyaniding, bright annealing of copper, and rapid heating for forging.

For additional annotations indexed in other sections, see:
3-190; 4-86; 13-37; 20-359; 22-318; 24-212; 25-97; 27-121.

19 WORKING—Rolling, Drawing, Forging

19-190. Extrusion Method of Manufacturing Tubes. Hugo Lorant. *Mechanical Engineering*, v. 69, June 1947, p. 471-474.

Process as used for tubes of stainless steel, special steel, nickel, monel, and Inconel.

19-191. Making Hand-Wrought Copper Products. M. G. Hawkins. *Modern Machine Shop*, v. 20, June 1947, p. 156-158, 160.

Most forming is accomplished by spinning. Fluting, annealing, hammering, trimming of copper articles at Empire Copper Works, Seattle, Wash.

19-192. Stamping Body Panels at Kaiser-Fraser. *Machine and Tool Blue Book*, v. 43, June 1947, p. 159-160, 162, 164, 166, 168.

Three to nine stamping operations are required to turn out each body panel. Larger body presses range in capacity from 350-ton single-action to 1500-ton triple-action.

19-193. Rolling Mills. E. A. W. Hoff. *Iron and Steel*, v. 20, May 23, 1947, p. 216-217.

Fluctuations of torque distribution between spindles as measured by electric-resistance strain gages.

19-194. Shaping Processes. E. Siebel. *Iron and Steel*, v. 20, May 23, 1947, p. 266-268.

Application of Hencky's laws of equilibrium to various forming processes.

19-195. Rolling Mill Research. *Iron and Steel*, v. 20, May 23, 1947, p. 278-280.

An abstract of the first report of the Sub-Committee of the Iron and Steel Industrial Research Council.

19-196. Pressworking of Stainless Steels. C. W. Hinman. *Steel Processing*, v. 33, June 1947, p. 385-387.

Properties of Cr-Ni stainless; drawing, polishing, and pressworking; and blanking small work in carbide dies.

19-197. Fuselage-Frame Production. S. C. Poulsen. *Aircraft Production*, v. 9, June 1947, p. 203-208.

Six-stage rolling machine for simultaneous forming and curving of circular frames from flat strip.

19-198. Drawing Die Problems and Formulas. Part III. James Walker. *Tool Engineer*, v. 18, June 1947, p. 35-38.

Selection of presses.

19-199. Versatile New Press Speeds Die Tryout. Gunnar Skog. *Tool Engineer*, v. 18, June 1947, p. 44.

Novel design incorporates positioning to provide on-the-spot corrections.

19-200. Servicing of Dies. *Wire and Wire Products*, v. 22, June 1947, p. 432-433, 462-463.

Maintenance of wire-drawing dies discussed in the form of a hypothetical conversation between the field investigator for a die manufacturer and the manager of a plant using them.

19-201. Experimentation on Tube Drawing With a Moving Mandrel. G. Espey and G. Sachs. *Journal of Applied Mechanics*, v. 14 *(Transactions American Society of Mechanical Engineers*, v. 69), June 1947, p. A81-A87.

In the process of tube drawing with a moving mandrel, the frictions act in different directions on the two contact surfaces between metal and tools. Therefore, the analysis of such a process yields rather complex relations. These were confirmed by experimentation on several materials exhibiting various degrees of strain hardening.

19-202. The Flow of Metals Through Tools of Circular Contour. G. Sachs and L. J. Klingler. *Journal of Applied Mechanics*, v. 14 *(Transactions American Society of Mechanical Engineers*, v. 69), June 1947, p. A88-A98.

In a large variety of commercial forming processes, metal flows through a gap formed by the surfaces of parallel cylinders. One of these processes is rolling, which has been investigated previously for certain boundary conditions. This analysis is extended to cover all possible variations.

19-203. Speed Stability of Motors for Continuous Mills. F. E. Crever and T. M. Linville. *Iron and Steel Engineer*, v. 24, June 1947, p. 50-58; discussion, p. 58-60.

How to minimize speed changes when sudden torque variations occur by providing inertia, or electrically by proper design of the motor.

19-204. Machinery for Roller Leveling Flat Rolled Metal. A. J. Wardle, Jr. *Iron and Steel Engineer*, v. 24, June 1947, p. 61-65, 68; discussion, p. 68.

Background, various types of machines. Number and placement of leveling rolls.

19-205. Rod Mills and Rod Mill Roll Design. Ross E. Beynon. *Iron and Steel Engineer*, v. 24, June 1947, p. 74-100.

A review of general practice.

19-206. Speed and Precision Required in Manufacture of Ford Hub Plates. P. D. Aird. *The Modern Industrial "Press"*, v. 9, June 1947, p. 13-14, 16, 18.

Forming, welding, and general fabrication procedure.

19-207. Mass Production of Urban Coaches Involves Efficient Metal Working Equipment and Methods. Walter Rudolph. *The Modern Industrial "Press"*, v. 9, June 1947, p. 26, 28, 32, 34.

Expansion of facilities at Twin Coach Co., Kent, Ohio, and Buffalo, N. Y. New design features. Use of aluminum alloys. Forming operations.

19-208. Machining Operations Eliminated by Formed Tubing. *Iron Age*, v. 159, June 19, 1947, p. 59.

New fabrication procedure used by National Formetal, Inc., Cleveland, to produce formed bushings and spacers having a large variety of specifications, and held to close tolerances. They are made in steel, bronze, and other copper alloys.

19-209. Successful Drawing and Redrawing Thin Metal Stampings. Wallace C. Mills. *American Machinist*, v. 91, June 19, 1947, p. 112-116.

Causes of tearing and wrinkling of thin metal and the precautions to be observed to prevent them.

19-210. The Manipulation of Magnesium Alloy Sheet and Extrusions; a Review of Published Information to Aug. 1946. (Concluded.) G. Goddard. *Magnesium Review and Abstracts*, v. 6, Oct. 1946, p. 122-131. 32 ref.

19-211. O Laminador Sendzimir Para Tiras E Chapas A Frio. (The Sendzimir Cold Strip Mill for Cold Forming Wire and Sheets.) Tibor Kessler. *Boletim da Associacao Brasileira de Metais*, v. 3, April 1947, p. 241-250.

A modern method of cold rolling and drawing. The advantages of this mill over the ordinary mill.

19-212. Use of Magnesium in Aircraft. *Light Metal Age*, v. 5, June 1947, p. 6-7.

Hot forming; dimpling; spot welding; and drop-hammer forming at Glenn L. Martin Co., Baltimore.

19-213. The Rolling of Metals: Theory and Experiment. Part XIV. Methods Used in Practice for the Calculation of Rolling Load and Horsepower. (Continued.) L. R. Underwood. *Sheet Metal Industries*, v. 24, June 1947, p. 1155-1160.

Four more illustrative examples. (To be continued.)

19-214. Practical Problems of Light Presswork Production. (Continued.) J. A. Grainger. *Sheet Metal Industries*, v. 24, June 1947, p. 1167-1170, 1174.

Procedures for press setting. (To be continued.)

19-215. Further Comments on the Merits of Hydraulic and Mechanical Presses for Sheet Metal Drawing. *Sheet Metal Industries*, v. 24, June 1947, p. 1171-1174.

W. Grimth Edwards and W. S. Rhodes comment on J. A. Grainger's article in the April issue. (To be continued.)

19-216. Die-Grams. Karl L. Buss. *Western Machinery and Steel World*, v. 38, June 1947, p. 123-124.

Die for production of precisely located hole in circular part.

19-217. Some Facts About Spinning Aluminum. *Modern Metals*, v. 3, June 1947, p. 16-17.

Some of the problems involved and the reasons why aluminum is an easy material to spin.

19-218. Form Tools. (Continued.) William F. Walker. *Edgar Allen News*, v. 26, June 1947, p. 842-845.

Circular form tools, tipped tools and composite tools. (To be continued.)

19-219. Small Sections Contoured by Preform Rolling. C. R. Wulffsohn. *Iron Age*, v. 159, June 26, 1947, p. 54-57.

Forming of extrusions and sheet metal stock into shapes requiring compound curvatures, contours and reverse contours and bends can be performed without the use of costly dies in a single operation by use of a simple power-roll machine. New technique offers a wide field of application in metal furniture and trim.

19-220. For Deep Drawing. Mechanical or Hydraulic Presses? *Tool & Die Journal*, v. 13, July 1947, p. 70-75.

An evaluation of factors influencing the selection of presses for specific jobs. Data were obtained from both a large manufacturer and a large user of mechanical and hydraulic presses.

19-221. Production Up, Downtime Down. *Tool & Die Journal*, v. 13, July 1947, p. 84-86.

How use of carbides for the cutout and cupping-die portions of a nine-stage progressive die enabled Thompson Products Co., Detroit, to increase the length of runs on rod bearings for the socket tie-rod assemblies for automotive vehicles from 200,000 to 2,000,000 before die reconditioning.

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Walter F. McCormack (Right) Receives the Muncie Chapter Bell and Gavel From Outgoing Chairman John M. Sherry. Second from left is Gene P. Davis, new vice-chairman, and Dallas F. Lunsford, secretary-treasurer

19-222. Carbide Inserts Eliminate Die Servicing. *Tool & Die Journal*, v. 13, July 1947, p. 86.

Use of above in production of small steel links.

19-223. Press Tooling and Production of Electric Motors. *Tool & Die Journal*, v. 13, July 1947, p. 98, 100, 102, 106F.

How problems in design of an all-steel, press-produced, fractional-horsepower, induction motor were solved.

19-224. Press Alignment of Punches and Dies. *Tool & Die Journal*, v. 13, July 1947, p. 104, 106G.

Anti-friction die sets and accessories. Experience of users shows an increase in stampings between regrinds of up to 100%, with 50% considered routine.

19-225. "Hypermatic" High-Velocity Stamping. *Tool & Die Journal*, v. 13, July 1947, p. 144.

Production results with new type of punch press. Lock washers are produced at a rate of 1700 per min. and 450,000 are produced without a die grind. The high velocity results in about 10% cut and 90% break, producing superior stampings with less burr, distortion, and draft.

19-226. Cemented Carbide Wire Straightening Dies. *Iron Age*, v. 160, July 3, 1947, p. 54.

Use of tungsten carbide for wire-straightening dies used in processing hot wire into concrete-reinforcing rods resulted in an increase in die life to more than 300 days, as compared with an average life of 2 days for chilled iron and brass dies.

19-227. Intermittent Deformation of Metals. *Metal Industry*, v. 70, June 27, 1947, p. 480.

Recent work on improving the cold drawability of a magnesium alloy.

19-228. New Press Operates at 1800 Strokes Per Min. H. E. Linsley. *Iron Age*, v. 160, July 10, 1947, p. 58-59, 127-128.

New type of punch press.

19-229. Press-Shop Operations in Making Silverware. *Machinery*, v. 53, July 1947, p. 152-153.

Blanking, drawing, forming, and trimming operations performed in the manufacture of silverware at Oneida, Ltd., Sherrill, N. Y., by use of power presses built by the E. W. Bliss Co.

19-230. Hot Forming Solves Bending Problem on 75S-T Aluminum. P. F. Girard. *Production Engineering & Management*, v. 20, July 1947, p. 63-64.

Laboratory procedure establishes feasibility of forming dihedral angle and sweepback in heavy section 75S-T extruded aluminum alloy wing spars at 300° F. at Ryan Aeronautical Corp.

19-231. Cast Plastics Drop Hammer Punch Dies. Gilbert C. Close. *Modern Machine Shop*, v. 20, July 1947, p. 166, 168, 170, 172, 174, 176, 178.

How cast ethyl cellulose plastic dies are prepared and used at El Segundo, Calif., by Douglas Aircraft, for forming sheet metal.

19-232. Liquid Power for Embossing and Drawing Sheet Metal in One Operation. *Machine and Tool Blue Book*, v. 43, July 1947, p. 189-190, 192, 197, 198, 200.

Using water under high pressure and only one die section, the new Hydrodynamic method permits the drawing and embossing of large and difficult shapes in one operation without localized draw strains.

19-233. Northrup Speeds Magnesium Fabrication. Chester Ricker. *American Machinist*, v. 91, July 17, 1947, p. 119-121.

How hot forming of magnesium plate, electric dimpling, and automatic welding cut time and cost in building all-magnesium aircraft.

For additional annotations indexed in other sections, see:

4-76; 9-77; 12-116-119-126-139; 18-125; 20-362-396; 21-67; 23-207-226-236-237-249; 24-212-224.

20 MACHINING AND MACHINE TOOLS

20-322. Machine Tools. *Russian Technical Research News*, v. 1, no. 6, 1947, p. 24.

Studies of the wear of thread-cutting dies led to formulation of an equation connecting wear with tooth geometry. Optimum reamer dimensions and reamer breaking strengths. (Translated and abstracted from Stanki i Instrument, no. 7-8, 1946.)

20-323. The Centerless Grinding of Bicycle Components. *Machinery Lloyd*, v. 19, May 24, 1947, p. 95-96.

Grinding of axles, cones and hubs by a British-made centerless grinder.

20-324. Tooling "Short-Cuts" Speed Engine Production. Gilbert C. Close. *Modern Machine Shop*, v. 20, June 1947, p. 124-128, 130, 132.

Tools and methods used in the manufacture of McCulloch motors.

20-325. Production With Light Machine Tools. Part II. John E. Hyler. *Modern Machine Shop*, v. 20, June 1947, p. 134, 136, 138, 140, 142, 144, 146, 148, 150, 152.

Bench lathes and bench-lathe tooling; turrets, cross slides, and stops; types of collets and collet closers.

20-326. Ideas From Readers. *Modern Machine Shop*, v. 20, June 1947, p. 194, 196, 198.

An emergency "lathe", by Elton Sterrett. Drilling opposite holes, by L. Kasper. Handy stock cabinet, by R. A. Shaw.

20-327. Various Ways of Accurately Mounting Workpieces of Different Shapes and Sizes, to Permit Different Cutting Operations. *Machine and Tool Blue Book*, v. 43, June 1947, p. 174, 176, 178, 180, 182-184, 186, 188, 190.

The manner in which a workpiece should be mounted on a lathe for the most efficient production is determined by many factors, all of which must be taken into account—the size and shape of the workpiece, the nature of the operation to be performed, the area and location of the workpiece surface to be worked. These factors determine what type of mounting should be employed to accomplish the desired results.

20-328. Using Carbides in Metalworking. H. A. Frommelt. *Machine and Tool Blue Book*, v. 43, June 1947, p. 211-212, 214, 216, 218, 220, 222, 224, 226, 228, 230.

Use in milling flats on overarms, setting rates of milling, cutting and clearance angles, metal removal rate, types of milling, surface finishing.

20-329. Direction of Maximum Crystal Elongation During Metal Cutting. G. H. Townend. *Journal of Applied Physics*, v. 18, May 1947, p. 489-490.

Points out error in paper by M. E. Merchant on mechanics of the metal cutting process. The expression connecting shear angle, rake angle, and maximum crystal elongation is shown to be incorrect, and a new expression is derived. This has been confirmed by Dr. Merchant, whose original paper appeared in v. 16, 1945, p. 267.

20-330. Correct Conical Truing on New Center Grinder. *Industrial Diamond Review*, v. 7, May 1947, p. 131.

Proper procedures using Swiss machine.

20-331. Can Appropriate Diamond Sizes Be Determined by Formulas? W. Jacobsohn. *Industrial Diamond Review*, v. 7, May 1947, p. 144-146.

The various factors together with a comparison of recommended grinding wheels for specific operations and materials.

20-332. Turning Railway Motor Commutators in Switzerland. P. Casal. *Industrial Diamond Review*, v. 7, May 1947, p. 147.

Procedures.

20-333. Fine Turning and Boring. *Industrial Diamond Review*, v. 7, May 1947, p. 151.

The development of the art on the continent. (Translated and condensed from *Technische Rundschau*, v. 39, March 14, 1947, p. 9.)

20-334. Machining Brass Tubes. *Industrial Diamond Review*, v. 7, May 1947, p. 153.

Procedure. (Translated from *Technische Rundschau*, v. 38, Nov. 22, 1946, p. 19.)

20-335. Two New Radial Grinding Heads. *Industrial Diamond Review*, v. 7, May 1947, p. 154.

Two British machine-tool attachments.

20-336. Notes on Jig Design. A. Ryding. *Machinery (London)*, v. 70, May 29, 1947, p. 565-569.

General recommendations on this subject, together with several examples incorporating what are considered essential features of good design.

20-337. Precision Taper Turning on the Multiple Spindle Automatic. *Screw Machine Engineering*, v. 8, June 1947, p. 40-42.

Illustrated by blueprint-type diagrams.

20-338. A Very Useful Method of Tooling for High Volume Production. Lewis N. Stewart. *Screw Machine Engineering*, v. 8, June 1947, p. 46-50.

Techniques for tooling a high-volume part such as a simple set screw; also several practical and useful ideas on additional tooling designed to reduce wear on vital machine parts.

20-339. Piercing Operation Performed on the Automatic Screw Machine. *Screw Machine Engineering*, v. 8, June 1947, p. 51-54.

How it can be accomplished.

20-340. Highlights on Threading. H. F. Wieler and R. E. Bender. *Screw Machine Engineering*, v. 8, June 1947, p. 60-62.

Series on "threading technique" is designed to approach the subject from simple basic terms, progressing from the wrong to right methods of chaser grinding and part design.

20-341. Stock Ends. *Screw Machine Engineering*, v. 8, June 1947, p. 65.

Stop adaptor, by John G. Ozga. Emergency left-hand drill, by Foster Marten. Internal chamfers, by Robert M. Stone.

20-342. Production of Hydraulic Equipment. Part II. *Aircraft Production*, v. 9, June 1947, p. 226-231.

Fixtures used in machining thin-walled and other work and highly accurate surface-finishing of small components at British firm.

20-343. Honing for Precision Stock Removal. A. C. Leuchtman. *Production Engineering & Management*, v. 19, June 1947, p. 60-64.

Its use on nonmetallic materials and on nonferrous metals.

20-344. Versatile Machines and Fixtures Reduce Down-Time for Setup. *Production Engineering & Management*, v. 19, June 1947, p. 66-74.

Improvements in production methods for manufacture of chains, conveyers, materials-handling and mechanical power-transmission machinery, at Link-Belt Co.'s two Philadelphia plants.

20-345. Higher Machine Speeds Require Better Tube Liners. Joseph T. Vinbury. *Production Engineering & Management*, v. 19, June 1947, p. 77.

How objectionable stock whipping on screw-machine bar reels can be eliminated with New Britain Machine Co.'s hour-glass spring-stock reel-tube liners.

20-346. Production Data Sheet. *Production Engineering & Management*, v. 19, June 1947, p. 81.

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Thrust loads due to drilling various metals.

20-347. The Crib. *Production Engineering & Management*, v. 19, June 1947, p. 83.

Lathe roller rest, by Thomas E. Davies. Repairing drawing bar, by Edward Diskavich.

20-348. New Lathe Tool Promises Greater Savings. *Tool Engineer*, v. 18, June 1947, p. 44.

Ejector-type carbide tool described results in savings in tool cost of 600%.

20-349. Drilling and Boring Tools. Part XI. *Tool Engineer*, v. 18, June 1947, p. 45-46.

Procedures and equipment for boring precision holes.

20-350. Self-Tightening Threads. Edwin C. Austin. *Tool Engineer*, v. 18, June 1947, p. 47.

Method for making by using taps with plus or minus lead error of 0.002 to 0.003 in. per inch.

20-351. Grinding Wheel Dresser. D. E. McDonald. *Tool Engineer*, v. 18, June 1947, p. 47.

Simple and inexpensive fixture.

20-352. How to Use Carbide Cutters for Milling. H. A. Frommelt. *Iron Age*, v. 159, June 12, 1947, p. 65-68.

Establishment of cutting rates for carbide milling differs greatly from procedures used for conventional milling. A simple step-by-step procedure illustrated by means of two examples.

20-353. How to Use Carbide Cutters for Milling. H. A. Frommelt. *Iron Age*, v. 159, June 19, 1947, p. 77-80.

Three more examples from actual shop practice are analyzed in full detail, including a skinning operation on a large magnesium billet. The method of selecting the most suitable size of milling cutter; a larger diameter cutter does not necessarily reduce the milling time.

20-354. Snakes in the Glass. Ananias MacHinery. *American Machinist*, v. 91, June 19, 1947, p. 108.

Use of specialized honing technique for diesel injector nozzles requiring 0.004-in. jet holes. The same technique was also found useful for cleaning of small-bore tubes.

20-355. Tone Stylus Provides Precise Duplicating. H. L. Seekins. *American Machinist*, v. 91, June 19, 1947, p. 109-111.

Use of an audible pressure-signaling device or tone stylus for a manually operated, profile-duplicating, milling machine which cuts centrifugal impellers for aircraft turbosuperchargers and provides an audiocontrol means for fast duplication of contours.

20-356. Hairline Precision in Shaver Making. Walter Rudolph. *American Machinist*, v. 91, June 19, 1947, p. 120-121.

Machine-shop procedures in manufacture of electric-shaver heads.

20-357. Practical Ideas. *American Machinist*, v. 91, June 19, 1947, p. 151-156.

Automatic tension nut improves hacksawing, by D. E. McDonald. Lathe milling can be practical, by Roger Isetts. Plunger check valve simplifies glass renewal, by W. Richardson. How to cut a corner chamfer, by F. W. Brady. Ball turning attachment uses power feed, by George A. Giller. Expanding mandrel tightens in blind holes, by Dana J. Mulholland. Special tools speed piston ring production, by F. G. Forquer. Drill press attachment rebores small motor-end bells, by George Burnley. Lateral extension attachment mills deep internal keyways, by C. D. MacKinnon. Lathe drill holder speeds deep drilling, by H. Moore. Edge bender forms heavy bar stock, by Edward S. Barrows.

20-358. Boring. Guy Hubbard. *Steel*, v. 120, June 23, 1947, p. 98-100, 141.

For work ranging in diameter from a fraction of an inch up to 40 ft. as handled on a wide variety of modern machine tools.

20-359. High-Volume Production of Passenger Car Axles. Joseph Geschelin. *Automotive Industries*, v. 97, July 1, 1947, p. 34-35, 67, 76.

Heat treating, cleaning, welding, and machine-shop operations.

20-360. Machining Problems in Production of Industrial Timing Mechanisms. C. R. Horton. *Materials & Methods*, v. 25, June 1947, p. 69-71.

Production methods used at Macnick Co.

20-361. Terminal Island's Heavy Machine Tools. Gordon B. Ashmead. *Western Machinery and Steel World*, v. 38, June 1947, p. 94-97.

Navy Yard equipment.

20-362. Methods of Increasing Fatigue Strength of Gear Teeth. *Machinery (London)*, v. 70, June 5, 1947, p. 601-602.

Following the ordinary finishing operation which produces surface-finishing lines parallel to the teeth and at right angles to the direction of rotation and load, lapping at the roots was used to create lines running parallel to the direction of rotation and load. A further development was the use of shot-peening of the root area after heat treatment to relieve stresses in the area of maximum stress.

20-363. Grinding Fixture for Brass Bracket. *Machinery (London)*, v. 70, June 5, 1947, p. 603.

20-364. Nonmetallic Table Ways for Planing Machines. *Machinery Lloyd (Overseas Edition)*, v. 19, June 7, 1947, p. 88-89.

Use of laminated phenolic resin ways on machines being built by American firm.

20-365. A New Automatic Duplex Centering Machine. *Machinery Lloyd (Overseas Edition)*, v. 19, June 7, 1947, p. 97.

British-made machine tool.

20-366. The Scope Multipurpose Lathe. *Machinery Lloyd (Overseas Edition)*, v. 19, June 7, 1947, p. 98-100.

British-made machine tool.

20-367. Gage for Measuring Taper Per Inch. *Machinery (London)*, v. 70, June 12, 1947, p. 624.

Shown diagrammatically.

20-368. Reduction Gearing for the Barbazon I. *Machinery (London)*, v. 70, June 12, 1947, p. 625-627.

Production of a large internal-bevel gear in British factory.

20-369. Jig Grinding. W. Bonham. *Machinery (London)*, v. 70, June 12, 1947, p. 628-631.

Equipment, methods, and applications. Working on the same principle as the jig borer for accurate location of the work, the jig grinder enables holes in hardened components to be ground and corrected to the same limits as are obtainable from the jig borer when working unhardened materials.

20-370. Accuracy Requirements for Heavy Machine Tools. J. H. Rivers. *Machinery (London)*, v. 70, June 19, 1947, p. 654-656.

Propeller-boss boring; crankpin-turning machines; and railway-wheel lathes.

20-371. Device for Machining Holes at Accurate Centers. *Machinery (London)*, v. 70, June 19, 1947, p. 657-658.

Patented device whereby accurately spaced holes can be machined in a workpiece, using an ordinary drilling machine.

20-372. Four-Way Duplicating Blocks. *Machinery (London)*, v. 70, June 19, 1947, p. 658.

Technique for transferring a set of holes on four sides from one shaft to another.

20-373. The "Matrik" Work Locater. *Machinery Lloyd (Overseas Edition)*, v. 19, June 21, 1947, p. 78-79.

Apparatus for speedy and accurate resetting of machine work for the finishing operation in cases where the work is roughed on one machine and finished on another.

20-374. A New Automatic Hob and Helical Spline Grinding Machine. *Machinery Lloyd (Overseas Edition)*, v. [illegible], June 21, 1947, p. 95-96.

British-made machine.

20-375. Compressed Air Power Provides Close Tolerances for Reel Production. *Steel*, v. 120, June 30, 1947, p. 83.

Use of compressed air-operated tools for several operations in cutting [illegible] parts of fly and baitcasting reels and in fitting them together.

20-376. Surface Machining. Part [illegible]. Guy Hubbard. *Steel*, v. 120, June [illegible] 1947, p. 64-65, 102, 104.

The origin and development of planers and shapers, and their importance today as basic types of modern machine tools.

20-377. Machining and Shearing Malleable Iron. Russell A. LaCombe. *Production Engineering & Management*, [illegible] 20, July 1947, p. 56-59.

How shearing operation permits removal of gates from malleable-iron fittings 400% faster with reduced health hazards and less fatigue.

20-378. Lathe Attachment Reduces Set-up Time. *Production Engineering & Management*, v. 20, July 1947, p. 62.

Mechanism which guides the motion of the standard lathe cutting tool in strict conformity with a master template of the finished piece.

20-379. Production Data Sheet. *Production Engineering & Management*, [illegible] 20, July 1947, p. 81.

Recommended design of single-point dovetail forms, and skiving tools for high speed cutting of brass on automatics.

20-380. The Crib. *Production Engineering & Management*, v. 20, July 1947, p. 83.

Dual grinding setup, by George W. Bruck. Repairing micrometers, by William Knoll.

20-381. Aircraft Engines of Tomorrow in Production Today. Charles H. Wick. *Machinery*, v. 53, July 1947, p. 136-[illegible].

The practice of the Allison Division, General Motors Corp., in producing jet engines. Welding, machining, and grinding operations on the turbine rotor wheel and buckets. (Concluded.)

20-382. Operations on Small High-Speed Automatic Turret Lathes. *Machinery*, v. 53, July 1947, p. 140-144.

Production data taken from typical shop operations on a variety of small aluminum and cast-iron parts.

20-383. Applying Light Drill Presses to High-Production Jobs. Charles Mar[illegible] *Machinery*, v. 53, July 1947, p. 146-150.

Ingenious tooling, quick-operating devices, and oil-bath cutting which permit over 100,000 parts per day to be turned, tapped, slotted, and threaded on ½-in. capacity drill presses.

20-384. Tool Engineering Ideas. *Machinery*, v. 53, July 1947, p. 181-183.

Quick-action boring fixture, by Donald A. Baker. Centerless grinder arranged for continuous and simultaneous work-feeding and wheel dressing, by Ernest Berger.

20-385. How to Use Carbide Cutters for Milling. H. A. Frommelt. *Iron Age*, v. 160, July 3, 1947, p. 69-72.

Step-by-step analysis clearly indicates value of face milling on the score of costs, finish and accuracy.

20-386. Carbides Hob Nonmetallic Gears. Leo W. Reuland. *American Machinist*, v. 91, July 3, 1947, p. 96-98.

Recent applications.

20-387. Punch Press Can Be Safe. W. A. Vollmer. *American Machinist*, v. 91, July 3, 1947, p. 99-103.

Enclosure-type guards for different jobs.

20-388. Practical Ideas. *American Machinist*, v. 91, July 3, 1947, p. 127-132.

Basic automatic chuck holds different parts, by F. Hartley. Spring Pa[illegible] allel, by Joseph Villiger. V-block, by F. J. Peragine. Chamfering, by Osc[illegible] Craft. Extension clamp, by Nicho[illegible]

(Turn to page 38)

Chapter Officers (Cont.)

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Rosmando. Long limit gage, by M. W. Bossman. Dovetail gaging blocks, by Benedict Benith. Sliding tray holds drawing instruments, by W. D. Chiverton. Converted caliper, by Walter J. Hoeckele. Adjustable V-blocks, by Edward J. Carey. Tailstock V-block helps position heavy work, by J. H. Quatkemeyer. Die sinking, by Cliff Bossmann. Telescoping gage measures large gate valve threads, by John Proctor. Anchored collet inserts, by John S. Curtiss. Blocked work and longitudinal feed cuts keyways in lathe, by Arthur Silvester. Repairing centers, by F. J. Peragine. Expanding extractor removes blind bushings, by Harry A. Livingston. Lathe taper attachment, by Donald A. Baker. Circle and straight line scriber, by L. Avril. Wheel dresser, by Arthur F. Hird. Steadyrest, by Edmund L. Johnson. Opaque guide and key seating tool, by Wallace E. Ryle. Scriber, by George Michaud.

20-389. Production With Light Machine Tools. Part III. John E. Hyler. *Modern Machine Shop*, v. 20, July 1947, p. 124-128, 130, 132, 134, 136.

Special applications of drilling equipment; bench shapers with special controls; automatic multiple-spindle tapping machine.

20-390. Accurate Adjustment for Precision Lead Screws. Roger W. Bolz. *Modern Machine Shop*, v. 20, July 1947, p. 138-140, 142, 144.

Method for easily adjusting thread-miller lead screw, which suggests possibilities of adaptation to similar mechanisms.

20-391. Ideas From Readers. *Modern Machine Shop*, v. 20, July 1947, p. 198, 200, 202, 204, 206, 208, 210, 212.

Traveling seat for operator speeds drill press operations, by Walter Rudolph. Taking kinks out of pulleys, by Robert Mawson. Gadget for cutting circles with welding torch, by George Winthrop Perry. Fixture for welding broken drills, by A. W. Payne.

20-392. Milling. Part V. Guy Hubbard. *Steel*, v. 121, July 7, 1947, p. 90-92, 118.

American inventions in milling machines from Eli Whitney's original down to the most advanced modern machine tools.

20-393. Hole Location Methods From Makeshift to Precision. Frederick C. Victory. *Machine and Tool Blue Book*, v. 43, July 1947, p. 137-144, 146.

Jig borer and jig grinder provide an efficient locating method, eliminate the translation step, and provide ideal machining conditions. A comparison between the new hole-locating machine and old methods.

20-394. Operation of an Engine Lathe. *Machine and Tool Blue Book*, v. 43, July 1947, p. 151-152, 154, 156, 158, 160, 162, 164, 166, 168, 170, 172.

Practical instructions for various typical jobs. Clarified by excellent diagrams.

20-395. How to Use Carbide Cutters for Milling. A Practical Conversion Problem. H. A. Frommelt. *Iron Age*, v. 160, July 10, 1947, p. 66-68.

Taking as an example the frame of a 700-hp., electric motor composed of a cast-steel section welded to a boiler-plate weldment, in continuous production. The problem of converting to carbide-milling operations. Axle pads and chamfers, and savings possible by use of higher powered equipment. (To be continued.)

20-396. Contour Sawing Practice as Related to Press Work. H. J. Chamberland. *Tool & Die Journal*, v. 13, July 1947, p. 79-83, 148, 150.

Compares contour sawing with ordinary sawing and with flame cutting. Techniques for use of contour sawing in production of punches and dies for stamping. Tests also showed that, for production of thin sheet-metal parts, contour sawing was more economical than the thin-die method for runs under 500 parts, and more economical than production press work for lots as high as 2000 parts.

20-397. Operators Solve Machine Modification Problems. H. W. Lancaster. *American Machinist*, v. 91, July 17, 1947, p. 112-113.

Irregular bores cut with tracing device. Extra stripper travel on multi-slide machine. Gasket cutter adjusts to fit new designs.

20-398. Practical Ideas. *American Machinist*, v. 91, July 17, 1947, p. 143-148.

Undulated bushing guides tool for chamfering elliptical holes, by Iser Herman. Simple lock clamps index plate between notches, by Fritz L. Keller. Two clamps simplify punch and die layouts, by Edward Diskavich. Offset jaw and limit snap gage-block gages, by Arthur J. Wormwood. Wedging eccentric clamps index plates tightly, by Lawrence Bastrup. Hole locater, by Ed. C. Grannell. Secondary vise jaw, by C. W. Pressey. Pin vise trammel, by Roscoe B. Boone. Drill jig air ejector, by A. F. Scoblic. Taper attachment improves vertical boring mill, by Charles Smithyman. Portable burring machine, by Harvey E. Essmann. Angle formulas, by Claes L. Hultgren. Identifying mandrels, by Thomas Trail.

For additional annotations indexed in other sections, see:

7-278; 9-75; 12-128-139; 14-174-183-184; 21-59-68; 23-207-213-236; 24-182; 25-97; 27-138-145.

21 LUBRICATION and Friction; Bearings

21-56. The Ball Bearing. T. B. Sansom. *Machinery (London)*, v. 70, May 22, 1947, p. 541-546.

Factors governing performance under various operating conditions.

21-57. Bearing Metals. Modern Developments for the High-Speed Diesel Engine. P. T. Holligan. *Metal Industry*, v. 70, May 23, 1947, p. 375-377; May 30, 1947, p. 402-404.

Properties required, structure, thickness of lining, cadmium base and aluminum base metals, and lead-bronze and copper-lead bearing alloys. (To be concluded.)

21-58. The Hydrodynamic Lubrication of Finite Sliders. Charles P. Boegli. *Journal of Applied Physics*, v. 18, May 1947, p. 482-488.

Two approximations are made in the solution of Reynolds' lubrication equation for the case of a finite slider. These approximations lead to a series of equations that are easy and rapid to use for flat sliders, and which are also applicable to curved sliders. Examples of their use are presented, and a number of calculations are made to determine the range of slider proportions to which they may be applied with sufficient accuracy.

21-59. Latest Trends in Machine Tool Lubrication. J. R. Keen. *Lubrication Engineering*, v. 3, May-June 1947, p. 53-54.

A general discussion.

21-60. Additives in Lubricating Greases. Gus Kaufman. *Lubrication Engineering*, v. 3, May-June 1947, p. 55-61.

The importance of field tests in evaluating greases containing additives. Several test procedures.

21-61. Specifications—Their Use and Misuse. Melville Ehrlich. *Lubrication Engineering*, v. 3, May-June 1947, p. 62-64.

A general discussion referring to lubricants.

21-62. Bits and Pieces. *Metal Progress*, v. 51, June 1947, p. 969-971.

Model sleeve and ring bearings, by John Boyd. Computations of tensile results, by J. Dunlap McNair. Identifying metallographic specimens, by M. H. Kalina. Rapid polish for silver plate, by Dennis R. Turner. Tumbler for small tool bits, by James McGuire. Simplified Jominy test piece, by Harry F. Ross. Photomacrographic procedure, by C. Patrick Kenyon.

21-63. Bearing Metals—Modern Developments for the High Speed Diesel Engine. P. T. Holligan. *Metal Industry*, v. 70, June 6, 1947, p. 419-420.

Silver bearings and bearing shell materials. (Concluded.)

21-64. Bearings Made From Steel Wool. *Iron Age*, v. 159, June 19, 1947, p. 63.

Landing gear strut bearings are made by impregnating steel wool with copper, or related material, to form a closely woven and relatively heavy section or a relatively porous bearing. These bearings resist both high temperatures developed by friction, and extreme cold. They also have all desired compression and friction characteristics and can be attached to adjoining parts by brazing.

21-65. Kinetic Boundary Friction. J. R. Bristow. *Proceedings of the Royal Society*, v. 189, March 1, 1947, p. 88-102.

In order to determine the fundamental principles of boundary lubrication and the nature of boundary lubricating layers, curves of boundary friction vs. velocity, using various sliding surfaces, were determined for a number of lubricants. Dependence of kinetic boundary friction on molecular weight is shown for a series of esters of the fatty acids, on percentage of fatty oil in a compounded lubricant and on temperature for a pure substance and a mineral oil. 25 ref.

21-66. Engineering Smoothness Into Ball and Roller Bearings. T. W. Morrison. *Electrical Manufacturing*, v. 40, July 1947, p. 104-105, 210.

How to prevent noise, a secondary effect of vibration, by avoidance of surface roughness, dirt, denting, eccentricity, and excessive tightness.

21-67. Design Factors Rule Bearing Fabrication. *SAE Journal*, v. 55, July 1947, p. 66-67.

Fabrication by the tubing method and by the strip process. (Digest of "Sleeve Bearing Lining Materials", by W. E. Thill.)

21-68. Soluble Oil Coolants. L. B. Johnson. *Steel*, v. 121, July 7, 1947, p. 110, 113, 142.

Their use in various machining operations on ferrous and nonferrous material. Data and formulas given are based on current use in large and small plants and on a wide range of work.

For additional annotations indexed in other sections, see:

5-49; 6-156; 23-224; 27-134.

22 WELDING Flame Cutting; Riveting

22-305. Examples of Various Welding Designs and Techniques. *Product Engineering*, v. 18, June 1947, p. 130-131.

Various ways to conserve weld material and to strengthen welded joints. Schematic diagrams depict many applications of welding techniques.

22-306. Fine Silver Welded Tubing. J. G. Henderson. *Product Engineering*, v. 18, June 1947, p. 160.

How to use atomic-hydrogen, carbon-arc or oxy-acetylene processes in welding silver tubing.

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NEW CHAPTER OFFICERS (*Cont.*)

Arnold L. Rustay (Left), Retiring Chairman of Worcester Chapter, Congratulates Lloyd G. Field, Upon His Election as Chairman

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Secretary—R. F. Vines, Dentists' Supply Co., York, Pa.
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X-Ray's War Use Described

Art Pace of the General Electric X-Ray Corp., Chicago, gave an interesting talk on the development of the X-ray and its use during the war before the Terre Haute Chapter. He touched on new uses, hazards and safety measures necessary.

22-307. Jigs and Fixtures for Resistance Welding. C. A. Burton. *Machinery (London)*, v. 70, May 22, 1947, p. 533-540.

Their design and application. Jig and fixture materials; magnetic location of component parts; sequence of loading, welding and unloading; jig and fixture clamping methods; fixtures for use with portable gun welders.

22-308. Magnesium. Welding Fire Prevention. *Machine and Tool Blue Book*, v. 43, June 1947, p. 233-234, 236, 238, 240, 242, 244, 246, 248-250, 252, 254.

Gas, arc and spot welding procedures.

22-309. Welding of Alloy Steel Piping. Eric R. Seabloom. *Industry and Power*, v. 52, June 1947, p. 84-88.

Characteristics of alloys and how to choose rods, preheat temperatures, and heat treatments to produce weldments that meet exacting service requirements.

22-310. Long Rails for Transfer-Table Pit Fabricated at Night. *Railway Engineering and Maintenance*, v. 43, June 1947, p. 577-578, 588.

Pressure welding and installation of six 1160-ft. lengths for use at the Missouri Pacific's shops in Sedalia, Mo.

22-311. Are You Interested in Getting Better Welding at Lower Cost? Lew Gilbert. *Industry and Welding*, v. 20, June 1947, p. 26-29, 60, 62.

Factors which determine the quality and cost of welding.

22-312. Check Your Machine Flame Cutting Procedures. Ross Yarrow. *Industry and Welding*, v. 20, June 1947, p. 40-42, 44.

Procedures used by Republic Welding & Flame Cutting Co., Cleveland.

22-313. Series Capacitors for Improving Voltage Regulation on Circuits Supplying Power to Resistance-Welder Loads. W. O. Bloomquist and R. C. Wilson. *General Electric Review*, v. 50, June 1947, p. 21-23.

The voltage regulation problem in resistance welding. Series-connected capacitors with supply line, load-center units, step-down transformers. Protective equipment.

22-314. Electric-Furnace Brazing. Allen T. Cole and H. M. Webber. *General Electric Review*, v. 50, June 1947, p. 25-31.

Use of the above for manufacture of insecticide bombs. Making and testing the joints; operation of roller-hearth furnaces and plant layout.

22-315. Solid Phase Pressure Welding Offers Production Cost Savings. *Production Engineering & Management*, v. 19, June 1947, p. 75-76.

Linde process offers potential saving in the production welding of tube ends and similar parts by mechanization. Welding time is dependent on material thickness and seam length.

22-316. Improved Welding Techniques Spark Success of Steel Plate Fabricator. *Steel Processing*, v. 33, June 1947, p. 358-359.

Methods used at Black, Sivalls & Bryson, Inc., Oklahoma City, Okla.

22-317. Underflux Welding of Mine-Locomotive Wheels. C. D. Ramsden. *Coal Technology*, v. 1, Nov. 1946, T.P. 2111, 11 p.

Procedures adopted by Pittsburgh Coal Co. Cost analysis.

22-318. Metal Joining and Induction Heat Treating in Technical Metal Processing, Inc., Plant. *Industrial Heating*, v. 14, June 1947, p. 1006, 1008, 1010, 1012, 1046, 1048.

Miscellaneous operations.

22-319. New Upsetting Technique in Blind Riveting. *Steel*, v. 120, June 23, 1947, p. 118, 142.

Latest development utilizing specially designed two-part monel rivet for blind riveting.

22-320. Resistance Welding Improves Appearance of Sheet Metal Signs. *Steel*, v. 120, June 23, 1947, p. 122.

Rocker-arm welder is used in most instances on the different metals from which these signs are made.

22-321. Classification of Arc Welding Electrodes. *Transactions of the Institute of Welding*, v. 10, April 1947, p. 45-50, 59.

Report from a joint committee set up by the Institute of Welding and the Arc Welding Electrodes Section Technical Committee of the British Electrical and Allied Manufacturers' Assoc.

22-322. Future Ships. Will They Be All-Welded? *Transactions of the Institute of Welding*, v. 10, April 1947, p. 51-59.

A discussion by a panel of experts.

22-323. Notes on Welding Applied to Ship Construction. R. J. W. Rudkin. *Transactions of the Institute of Welding*, v. 10, April 1947, p. 60-66.

Economic considerations; combination of welding and riveting; radiography; development of welding technique; fabricated subassemblies; automatic welding.

22-324. Some Problems in the Approach to Welding Design. R. G. Braithwaite. *Transactions of the Institute of Welding*, v. 10, April 1947, p. 67-71.

The design of efficient welded structures demands a more detailed study of the physical and metallurgical properties of metal than is required in riveted structures. The use of high-tensile steel in bridge construction and stress distribution in welds and the factors involved in rigid joints.

22-325. The Relationship Between Welding Conditions and the Strength and Quality of Single Spot Welds in Deep Drawing Quality Mild Steel Sheet in Thicknesses From 20 to 14 S.W.G. A. J. Hipperson. *Transactions of the Institute of Welding (BWRA Supplement)*, v. 10, April 1947, p. 3-10.

Results of an extensive experimental investigation are tabulated and charted.

22-326. An Apparatus for the Butt Welding of Fine Wires. L. D. Armstrong and T. M. Dauphinee. *Canadian Journal of Research*, v. 25, Section F, May 1947, p. 221-225.

Apparatus using a condenser discharge is suitable for most types of fine wires. Welding characteristics and possible applications.

22-327. Shop Testing to Determine Standard Procedure for Welding Rail Joints. Richard D. Snouffer. *Mechanization*, v. 11, May 1947, p. 86, 88, 123.

Procedures and equipment used by Pittsburgh Coal Co., at Library, Pa.

22-328. Metallized Glass for Low Cost Joining of Glass to Metal. Harold G. Vogt. *Materials & Methods*, v. 25, June 1947, p. 81-83.

Glass-metal bonding methods; characteristics of metallized glass; soldering techniques; design factors; applications.

22-329. Continuous Soldering of Small Motor Rotors Using High-Frequency Heat. W. L. Tesch and Paul A. Greenmeyer. *Materials & Methods*, v. 25, June 1947, p. 94-96.

High production and accurate control are achieved in the soldering of tiny motor rotors through the use of high-frequency heat and automatic feeding.

22-330. Hard Facing Materials. H. R. Clauser. *Materials & Methods*, v. 25, June 1947, p. 103-118.

The basic types of hard facing materials and their selection. Complete table of hard facing electrodes—a reference list of electrode types, trade names, compositions, and characteristics. Refers only to the hard surfacing done by welding.

22-331. Metallic Joining of Light Alloys. (Continued.) *Light Metals*, v. 10, June 1947, p. 273-275.

The difficulties of fluxless flame welding and the special problems to be encountered with aluminum. The process is described with reference to copper. (To be continued.)

22-332. Some Fundamental Principles for the Resistance Welding of Sheet Metal. (Continued.) H. E. Dixon. *Sheet Metal Industries*, v. 24, June 1947, p. 1221-1226, 1230.

Spot welding, flash welding and seam welding of low-carbon steel; resistance welding of medium carbon and low-alloy steels; and resistance welding of austenitic stainless steels and of aluminum-base alloys. (To be concluded.)

22-333. The British Welding Research Association Symposium on the Welding of Light Alloys: Methods of Surface Preparation of Light Alloys for Spot Welding. F. C. Dowding. *Sheet Metal Industries*, v. 24, June 1947, p. 1232-1236, 1238.

Contact-resistance measurements; surface preparation of duralumin and of aluminum-magnesium alloys; the effect of scratch brushing and surface roughness; preparation of magnesium-base alloys; the cleaning of Alclad with paste etch; and pickling solutions for aluminum-base alloys.

22-334. The Development and Improvement of Spot Welding Electrodes. (Concluded.) G. F. James. *Sheet Metal Industries*, v. 24, June 1947, p. 1227-1230.

Microstructure of electrode tips; examination of physical and mechanical properties of electrode materials; effect of temperature on hardness.

22-335. Metal-Ceramic Vacuum Seals. Neal T. Williams. *Review of Scientific Instruments*, v. 18, June 1947, p. 394-397.

Wartime German vacuum-tube research led to the development of metal-ceramic silver-soldered vacuum seals. It has been found that such seals can be made successfully with ceramic materials available in this country. The procedure and precautions.

22-336. Spot Welders With Series Capacitors. F. L. Brandt. *Welding Journal*, v. 26, June 1947, p. 499-503.

Advantages of the equipment. Cost data are calculated, and operation of the equipment is shown by oscillograms.

22-337. Welding of Heavy Gray Iron Castings. L. J. Larson. *Welding Journal*, v. 26, June 1947, p. 504-511.

Sensitivity of gray iron to heat treatment limits use of welding. Nevertheless six methods have been successfully used for repair of gray-iron castings. These are: metallic-arc welding; oxy-acetylene welding; carbon-arc welding; bronze welding; thermit welding; and burning.

22-338. Rigid, Unique Water-Sphere Design Gained by Use of Electric-Arc Welding Process. A. F. Davis. *Welding Journal*, v. 26, June 1947, p. 512-513.

Fabrication and erection procedures.

22-339. The Effect of Welding Technique on Brittle Transition Temperature. Nicholas Grossman and Paul R. Shepler. *Welding Journal*, v. 26, June 1947, p. 321s-331s.

Twelve different methods were used to weld A-212 steel plates. Welding techniques could be divided into two general groups on the basis of the brittle transition temperature: E6010, E6020, and oxy-acetylene hand-welding showed that either the heat-affected zone or the weld metal was less ductile than the base plate; Unionmelt and HTS techniques both exhibited the most favorable conditions for applications where ductility is required with the weld metal more ductile than the unaffected plate. Speed of welding had little effect on the ductility of the weldments. 14 ref.

22-340. Effect of Welding on Ductility and Notch Sensitivity of Some Ship Steels. R. D. Stout, L. J. McGeady, C. P. Sun, J. F. Libsch and G. E. Doan. *Welding Journal*, v. 26, June 1947, p. 335s-357s.

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Strain Gages Used for Performance Tests on Heavy Machinery

Reported by Hans J. Heine

Metallurgist, Rockwell Mfg. Co.

Performance characteristics in heavy machines, such as torques developed in certain shafts, pulls in lines, forces required to move hand levers, tension in clutch bands and stresses at critical sections can be practically determined by use of strain gages, J. H. Meier, research engineer with Bucyrus-Erie Co., told a large group of Pittsburgh Chapter members. Many of the machines his company makes are so big that they cannot be completely assembled at the works, and are therefore tested only in the field.

Experimental stress analysis encompasses all means by which the stress distribution in a body or on its surface can be determined by measurement, Dr. Meier explained. Mechanical and optical strain gages are the oldest tools of experimental stress analysis. Mechanical gages, however, are cumbersome to handle and are unsuited for remote reading, while optical gages are primarily a laboratory tool.

Photo-elasticity solves problems that could not be handled by any other experimental method, although its application probably requires more mathematical skill. Stress distribution around holes and stress concentration at fillets and notches are typical examples. Photo-elasticity is strictly a laboratory tool for static problems, since its application to stress analysis under dynamic conditions might require a very elaborate optical setup.

The brittle lacquer technique of stress analysis best known as Stresscoat is coming into ever wider use. The principle involved is based on the fact that if a thin coat of brittle lacquer is applied to a solid body, and the body is stressed, cracks will develop perpendicular to the direction of the greatest elongation strain. In general, the higher the tensile strain, the closer will be the cracks.

Great strides have been made to develop both lacquers and techniques which will yield reliable quantitative results. However, its use, according to Dr. Meier, still requires a considerable amount of skill and possibly a grain of luck. Thickness of the lacquer, temperature and humidity of the surrounding air are factors that influence quantitative results. Dye-etching makes the crack pattern more visible and preserves it. Even so, it is often difficult to photograph a cracked pattern. Stresscoat investigation can be extended for more accurate quantitative results by using SR-4 gages, and this combination of tools is very effective.

Dr. Meier explained both verbally and pictorially the application and construction of SR-4 electric strain gages, and emphasized the importance of a proper bond between object and paper base, and paper base and filament. Torques, forces or bending moments which can readily be observed via strains in sections of known dimensions are investigated with SR-4 gages. Where strain gages cannot be readily applied to parts, calibrated links of heat treated steel can be inserted and the strain gages fastened to the links.

For dynamic work, Dr. Meier has used a cathode-ray oscillograph for recording strain functions on a continuously moving film. One of the outstanding features of SR-4 gages is their low inertia and their excellent undistorted dynamic response.

Heads Alabama Met. Dept.

E. C. Wright ● has become head of the department of metallurgical engineering of the University of Alabama at Tuscaloosa, Ala. Mr. Wright had been assistant to the president of National Tube Co. for the last four years. Previous to that, he had served as chief metallurgist of the Ellwood City plant for 10 years, and as chief metallurgist in the Pittsburgh office for seven years.

In addition to his teaching duties, Mr. Wright will be engaged in research and consulting work at Tuscaloosa.

Metallographic Exhibit

A PROMINENT area has been set aside at the International Amphitheatre in Chicago for the ●'s Second Metallographic Exhibit, held concurrently with the 29th National Metal Congress and Exposition. The rules will be found in the advertisement on page 51 of this issue; they are few and simple. No entry fee is charged. Rewards are ribbons in each classification, and a certificate and a substantial cash prize for the best micro in the show.

Extensive report covers the effects of variables such as base plate, electrode type, heat input, power input, number of passes, and postheating; metallurgical structure and dissolved gas. Welded longitudinal notch bends and Charpy bars subjected to heat and atmosphere treatments are used.

22-341. A Preliminary Investigation of the Spot Welding of Scaly and Rusty Structural Steel. W. C. Doty and W. J. Childs. *Welding Journal*, v. 26, June 1947, p. 358s-362s.

Welds were made by a preheat and weld sequence involving variable current and pressure. Spot weld consistency was studied using scaly steel having little or no rust, and also with steel which was both scaly and rusty. It was tentatively concluded that with rust-free scaly steel, satisfactory spot welding can be accomplished with reasonable electrode life and weld strength consistency using a preheat and weld procedure. Welds made in rusty, scaly steel have poorer consistency and cause more rapid electrode deterioration.

22-342. Hot Cracking of 7% Aluminum Bronze Multi-Run Welds. E. C. Rollason and W. D. March. *Welding*, v. 15, June 1947, p. 252-256.

Effects of fluxes, of wire, and crystal-boundary effects evaluated experimentally.

22-343. The "Weldomat" Process. *Welding*, v. 15, June 1947, p. 257-260.

A new automatic arc welding process recently introduced in Great Britain. The equipment is especially suitable for work in shipyards.

22-344. Resistance Welding in Mass Production; Principles of Projection Welding. A. J. Hipperson and T. Watson. *Welding*, v. 15, June 1947, p. 261-270.

The range of projection welding and recommendations as to operating technique likely to produce the best results. The effect of the welding variables.

22-345. Jointing of Brass: A Survey of Methods and Applications. Edwin Davis. *Welding*, v. 15, June 1947, p. 271-279.

The techniques of joining copper-zinc alloys by brazing, gas welding, arc welding, and resistance welding.

22-346. Oxygen Cutting; Manual Methods. E. Seymour Semper. *Welding*, v. 15, June 1947, p. 280-285.

Hand-cutting methods and equipment.

22-347. Soldering and Brazing Stainless Steels. H. Seymour. *Industrial Chemist*, v. 23, June 1947, p. 369-372, 379.

Preparation of surface; importance of flux; corrosive nature of fluxes; procedure for various joints; butt joints; silver brazing; steel to steel joints; dangers due to overheating; different heating procedures.

22-348. Soldering Aluminum. G. W. Birdsall. *Iron Age*, v. 159, June 26, 1947, p. 53.

Recommended techniques.

22-349. Metal-Ceramic Brazed Seals. R. J. Bondley. *Electronics*, v. 20, July 1947, p. 97-99.

New method involves applying titanium hydride to ceramic, then brazing to metals or similarly prepared ceramics with silver or any other metal that melts at 1000° C. Resulting seal, gastight and stronger than ceramic itself, is ideal for microwave tubes.

22-350. Lead Welding Practices. *Linde Tips*, v. 26, July 1947, p. 73-79.

Some helpful suggestions for welding lead sheet and pipe.

22-351. A Circle-Cutting Attachment for the CM-16. *Linde Tips*, v. 26, July 1947, p. 82.

How to make this device for the Oxweld cutting machine.

22-352. Aluminum Barrels by the Hundred. *Linde Tips*, v. 26, July 1947, p. 84-85.

Fluxless heliarc welding process eliminates postweld cleaning.

22-353. The Powder-Cutting Process. *Linde Tips*, v. 26, July 1947, p. 89-90.

Method for cutting stainless steels as easily as carbon steel.

22-354. Large Jobs Repaired by Bronze Welding. *Linde Tips*, v. 26, July 1947, p. 92-93.

Pictures and descriptive material illustrate several of the above.

22-355. Templet Tracing With a Portable Machine. *Linde Tips*, v. 26, July 1947, p. 95-96.

Rod templet and grooved-drive wheel which adapts portable cutting machine for stack-cutting of shapes.

22-356. Mechanized Bronze Welding. *Linde Tips*, v. 26, July 1947, p. 98-99.

Novel setup which speeds production of tube rings.

22-357. How to Select Hard Facing Materials. H. W. Sharp. *Iron Age*, v. 160, July 3, 1947, p. 62-66.

The four major groups of hard facing alloys and the general fields of application for each group. Photomicrographs show why each type possesses its particular characteristics. Current industrial applications; economic advantages.

22-358. Stainless Steel Welding Electrodes. *American Machinist*, v. 91, July 3, 1947, p. 147.

A.S.T.M. specifications.

22-359. Continuous Furnace Brazing. Part I. Design and Handling. C. L. West. *American Machinist*, v. 91, July 3, 1947, p. 124-125.

Metal products may be turned out at lower processing cost by using two or more parts in assembly by continuous brazing.

22-360. Pipe for the "Biggest Inch". Fred M. Burt. *Welding Engineer*, v. 32, July 1947, p. 33-37.

Production of 60-ft. sections of 30-in. pipe by Consolidated Steel Corp., Los Angeles, on an assembly-line basis, using specially designed machines for submerged-melt automatic welding.

22-361. Open-Circuit Voltage Goes Down. C. P. Croco. *Welding Engineer*, v. 32, July 1947, p. 38-41.

History of effort to secure lower voltages for a.c. welding. Using a stabilizing capacitor, it is now possible to operate at an open-circuit voltage of 55. (Condensation of paper presented at meeting of American Welding Society, Oakland, Calif.)

22-362. Beer From Welded Barrels. Edward F. Lee. *Welding Engineer*, v. 32, July 1947, p. 48-49.

Methods used in production of the barrels.

22-363. Ship Propellers Repaired by Brazing. Louis M. Friedmann. *Welding Engineer*, v. 32, July 1947, p. 50-52.

Details of the procedure developed at one large shipyard.

22-364. Three-Phase Welding. J. L. Solomon. *Steel*, v. 121, July 7, 1947, p. 94-96, 98, 137, 138, 140.

System puts balanced load on all three phases extending the scope of resistance welding processes and lowering substantially power demand.

22-365. Methods for Placing Brazing Materials, and Vent Locations. *Product Engineering*, v. 18, July 1947, p. 124-125.

Location and forms of copper used in brazing and positions for vents to prevent deformation of the final product. Two examples of joining dissimilar materials by brazing are given.

22-366. Nine Years of Strip Welding on the New Haven. A. L. Bartlett. *Railway Engineering and Maintenance*, v. 43, July 1947, p. 675-677.

Building-up battered rail ends. Experiences with strip welding and advantages. New electric slotter, light weight electric grinder, a tractor cylinder carriage, a rail grinder to remove corrugations, and a cutting-torch weld surfacer.

22-367. Continuous Furnace Brazing. Part II. How to Select and Apply Brazing Media. C. L. West. *American Machinist*, v. 91, July 17, 1947, p. 122-124.

Methods analysis for brazing saves time, money, and material by insuring proper application of media, heat, and equipment.

For additional annotations indexed in other sections, see: 7-273; 8-89; 9-78; 12-115-116-118-127; 14-177; 15-21-22-25; 19-206-212-233; 20-359-381-391; 23-214-222-236-237-238-245-252; 24-177-203-206-207-208-213-218; 25-97; 27-123-129.

23 INDUSTRIAL USES and Applications

23-203. High Pressure Oscillating Shower Pipes and Stainless Steel Plates With Rotary Screens. F. F. Frothingham. *Paper Trade Journal*, v. 124, May 29, 1947, p. 118, 120.

Equipment for rotary screening of paper stock. Advantages of this type.

23-204. Purity in Die Castings. J. C. Brigham. *Die Castings*, v. 5, June 1947, p. 17-18, 38-39.

Use of aluminum die castings for portable water-filtration units.

23-205. Die Castings in a Garbage Eliminator. *Die Castings*, v. 5, June 1947, p. 20-22, 40-42.

Manganese steel cutters, pivoting in a die-cast zinc hub, cut garbage so it can be flushed down the drain.

23-206. Die Castings—a la Mode. *Die Castings*, v. 5, June 1947, p. 32-37.

New type of rapid home ice-cream freezer constructed mainly of aluminum die castings.

23-207. Quantity Production of Springs and Bumpers at United States Spring & Bumper Co. Fred Burt. *The Modern Industrial "Press"*, v. 9, June 1947, p. 22, 24, 38.

Operational details including forming and machining.

23-208. Techniques Are Improved for Aluminum Therapy. A. W. Jacob. *Engineering and Mining Journal*, v. 148, June 1947, p. 84-88.

Latest engineering aspects of silicosis prevention. (Condensed from paper presented before the Canadian Institute of Mining and Metallurgy, Jan. 1947.)

23-209. Engineering Applications of Electrodeposited Coatings. Myron B. Diggin. *Metal Finishing*, v. 45, June 1947, p. 78-80.

Developments in chromium, nickel, iron, copper, tin, and precious metal plating.

23-210. Wire Cord Tires for Heavy Duty Trucks. Harry P. Coats. *Metal Progress*, v. 51, June 1947, p. 959.

Application for cold drawn steel wire, containing 0.60% Mn.

23-211. Better Tools From Molded Laminates. Lawrence Wittman. *Modern Plastics*, v. 24, June 1947, p. 132-137.

Use of glass fabric impregnated with unsaturated polyester resins and addition-type polymers in production-line fixtures and tools.

(Turn to page 44)

National Officers' Night in Denver—Without Officers

Left to Right Are Rudolph Smith, Chairman, Pueblo Group; A. L. Boegehold, National President (in Absentia); J. K. Garretson, Chairman, Denver Group; W. H. Eisenman, National Secretary (Ghost); J. L. Higson, Newly Elected Denver Group Chairman; and Floyd R. Anderson, the Substitute Speaker

Reported by J. K. Garretson
District Sales Manager
Republic Steel Corp.

Flood waters in Iowa prevented President Boegehold and Secretary Eisenman from reaching Colorado to attend National Officers Night in Colorado Springs on Friday, June 13. Despite this disappointment the joint meeting of the Denver Chapter with the Pueblo Group was held as planned, with 95 members present. When it was learned at 8:30 p.m. that the "high-class talent from the East" was marooned in an Iowa cornfield, an appeal was made to Floyd R. Anderson, chief metallurgist, Gardner-Denver Co., to substitute as speaker, and he responded in his own inimitable style with a hastily prepared discussion of "Surface Properties of Metals and the Benefits Derived From Grinding and Polishing Machine Parts."

Surface Layers Strengthened

Structure and properties of metal surfaces play an important role in determining the service life of machine parts, he pointed out; parts often fail by repeated stressing, and not by direct tension, compression, or torsion. The surface layer can be strengthened by carburizing, hardening, and shot-peening. Mr. Anderson explained the detrimental effects of carbide concentration in the surface of a carburized case and told how they can be minimized or eliminated by grinding or other methods.

The presence of the national officers seemed to be felt in spirit, even though they were absent in body. (Even the photographer seems to have caught the "spirit"—see cut.) Indeed, the meeting was such a success that those in attendance voted to hold a joint meeting at the Springs every year—on some other night than Friday the 13th.

FOOTNOTE BY W.H.E. to J. K. GARRETSON: I felt right at home in that Iowa cornfield, but President Bergie was a trifle restless and both of us quite disturbed when the diner ran out of food. We would much have preferred to be spirits in the Garden of the Gods than big fish in a prairie pond.

23-212. Lustron Corp. *Architectural Forum*, v. 86, June 1947, p. 105-110.

Details of prefabricated, enameled-steel house soon to go into production.

23-213. Production of Swing Spout Faucets. *Tool Engineer*, v. 18, June 1947, p. 24-29.

Plant layout, equipment, materials, and process methods at the General Tire and Rubber Company plant at Pasadena. The faucets are made from brass stampings, brass tubing, and precision-machined brass fittings. These are subassembled and permanently silver-brazed, then sanded, buffed, polished, cleaned, and chromium-plated.

23-214. Work Flow Speeds Job-Shop Welding. *American Machinist*, v. 91, June 19, 1947, p. 147-149.

Production of petroleum-product storage and dispensing units by American Welding & Manufacturing Co., Warren, Ohio.

23-215. New Fields for Stainless. Fred P. Peters. *Scientific American*, July 1947, p. 10-12.

New applications.

23-216. Advanced Production Methods Used at Buick Engine Plant. *Automotive Industries*, v. 97, July 1, 1947, p. 40-41.

Picture story.

23-217. Toroidal Iron Dust Core Coils and Their Possible Uses. *Brown Boveri Review*, v. 33, Aug. 1946, p. 219-221.

Dimensions, properties, and advantages of powdered-iron cores of toroidal shape made by Brown Boveri.

23-218. Carbonetos Duros Cementados. (Hard Cemented Carbides.) Vicente Chiaverini. *Boletim da Associacao Brasileria de Metais*, v. 3, April 1947, p. 333-359.

Principal uses and methods of manufacture of "Widia" cutting tools. Information obtained in American metallurgical research laboratories.

23-219. Over the Horizon Comes the "Beauty-Mobile". *Steel Horizons*, v. 9, no. 3, 1947, p. 5.

Use of stainless steel in mobile beauty shop.

23-220. Pfaudler Found a Way. *Steel Horizons*, v. 9, no. 3, 1947, p. 10-11.

Fabrication of stainless-steel tanks by Pfaudler Co., Rochester, N. Y.

23-221. Hot Seat of Horsepower. *Steel Horizons*, v. 9, no. 3, 1947, p. 23-25.

Manufacture and principles of sodium-cooled valves for aircraft engines.

23-222. 250-Ton Welded Barge. S. Castledine and P. B. Chrich. *Welding*, v. 15, June 1947, p. 244-251.

Methods of construction followed by The Butterley Co., Ltd., for the fabrication of all-welded steel barges.

23-223. Modern Magnetic Materials. H. E. Pinke. *Materials & Methods*, v. 25, June 1947, p. 72-76.

Properties and applications of the Alnicos, Cunife, Cunico, Vectolite, and Silmanal. These alloys can be designed to almost any shape, since with one or two exceptions they can be rolled, punched, machined, or ground.

23-224. Manufacture of Balls for Bearings and Pens. James Porterfield. *Materials & Methods*, v. 25, June 1947, p. 97-100.

Processes used in manufacture of tiny balls for instrument bearings and ball-point pens. Use of balls instead of jewels for watch bearings is being considered.

23-225. Chromium-Nickel Caskets. William P. Brotherton. *Western Machinery and Steel World*, v. 38, June 1947, p. 102-104, 125.

Production at Ryan Aeronautical Corp.

23-226. Hydraulics in Mass Production. *Western Machinery and Steel World*, v. 38, June 1947, p. 115-116, 126.

Manufacture of hydraulic forming presses at Hufford Machine Works, Redonda Beach, Calif.

23-227. Aluminum in Rural Construction. Frank B. Hastings. *Sheet Metal Worker*, v. 38, June 1947, p. 48-49.

Use of aluminum roofing and other applications.

23-228. Light Metals for Electronic Equipment. L. A. Hammarlund. *Modern Metals*, v. 3, June 1947, p. 14-15.

Applications to various parts some of which have been made of light metals for the past 37 years.

23-229. Light Metals for Sculpturing. Lawrence Tenney Stevens. *Modern Metals*, v. 3, June 1947, p. 18-20.

Applications of aluminum and magnesium.

23-230. Air Conditioning Accessories. *Modern Metals*, v. 3, June 1947, p. 26.

New applications of aluminum.

23-231. Light Alloys in the Internal-Combustion Engine. *Light Metals*, v. 10, June 1947, p. 265-270.

Historical background; use of light metal in compression-ignition engines; and design and properties of light-alloy pistons. (To be continued.)

23-232. Aluminex Roof Glazing. *Machinery Lloyd (Overseas Edition)*, v. 19, June 7, 1947, p. 105.

Use of an aluminum alloy for the window frames used in skylights. Unique design holds the glass without leakage or special clips.

23-233. Magnesium Alloy Developments. *Aeroplane*, v. 72, June 13, 1947, p. 629-630.

Various applications of magnesium for aircraft components by Essex Aero, Ltd. Use for gas tanks is emphasized by charts showing weight savings.

23-234. Driving Nails in Steel Flooring. *Steel*, v. 120, June 30, 1947, p. 98.

Special flooring with grooves to take nails is designed to reduce maintenance costs for railway freight cars, trucks, and trailers. The wooden flooring commonly used needs frequent replacement because of nailing into it to hold freight in place.

23-235. Metal-Clad Wall Material. *Steel*, v. 120, June 30, 1947, p. 101.

Unit consisting of a sandwich-type material having exterior and interior facing of steel and core of insulation, such as Foamglas, is expected to reduce construction costs on multistory buildings.

23-236. Development Work Reduces Product Cost. J. T. Lancaster. *Production Engineering & Management*, v. 20, July 1947, p. 77-79.

Miscellaneous machining, forming, and assembling processes being used in intermediate sized production shops in Canada.

23-237. Welded Sheet Metal Brake. *Linde Tips*, v. 26, July 1947, p. 94.

How to make tool for bending sheet-metal sections up to 12-gage thickness and 6-ft. length.

23-238. Plug-Welded Dipper Joints. T. A. Ratkowski. *Welding Engineer*, v. 32, July 1947, p. 54, 56.

Design and construction of welded power-shovel dippers.

23-239. Metallized Circuits Cut Wiring Costs. John T. Collier. *Metco News*, v. 4, July 1947, p. 6-7.

Descriptive.

23-240. Aluminum Timing Gears Made by Al-Fin Process. *Iron Age*, v. 160, July 3, 1947, p. 74.

Process claimed to produce gears substantially stronger than the molded resin-and-fiber gears commonly used in automobile engines. The gears are composed of aluminum alloys chemically bonded to steel hubs.

23-241. Scientific Design. *Die Castings*, v. 5, July 1947, p. 24, 26, 28-29.

Varied applications of die castings for school and laboratory equipment produced by W. M. Welch Mfg. Co.

23-242. Steel Inserts in a Die-Cast Zinc Tube Cutter. *Die Castings*, v. 5, July 1947, p. 29-30.

Use of inserts of other metals to supplement the physical properties of die castings for a small tube cutter manufactured by the Nye Tool Co., Chicago.

23-243. Reading on the Ceiling. J. A. Van Den Brook. *Die Castings*, v. 5, July 1947, p. 32-36.

Describes development of ceiling projector for hospitals, using many die-cast parts (aluminum and zinc).

23-244. High Strength—Low Weight. *Die Castings*, v. 5, July 1947, p. 42-43, 45-47.

Use of magnesium die castings for portable-tool parts.

23-245. Welding: Its Implications and Applications. Part II. Paul Weidlinger. *Progressive Architecture*, v. 28, July 1947, p. 78-81.

Present and potential applications in building construction.

23-246. Wrought Iron Used Effectively in Marine-Pier Fire Walls. *Railway Age*, v. 123, July 5, 1947, p. 49-50.

Use of wrought iron to replace deteriorated concrete fire stops under two piers of the N. & W. R. R. at Lambert Point, Va.

23-247. Coach-Baggage Car Constructed of Aluminum Alloys. *Product Engineering*, v. 18, July 1947, p. 104-105.

New car which weighs approximately 34% less than car of conventional steel construction.

23-248. Toolsteel Production in a Modernized Plant. R. J. Knerr and H. C. Bigge. *Machinery*, v. 53, July 1947, p. 172-175.

Equipment and techniques used at Bethlehem plant of Bethlehem Steel Co.

23-249 Fabricating Aluminum Air Ducts. *Steel*, v. 121, July 7, 1947, p. 93, 124.

Typical setup for use of coiled sheet.

23-250. Molded Vinyl Phonograph Records. F. B. Stanley. *Modern Plastics*, v. 24, July 1947, p. 107-111.

Methods of production, development work, and research being conducted at Bakelite Corp.'s Bound Brook Laboratories. Also describes production of records from aluminum discs around which are molded a shell of vinylite resin.

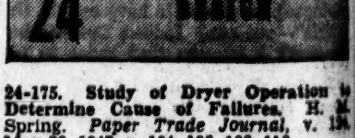
23-251. Added Attraction. O. A. Battista. *Steelways*, July 1947, p. 8-12.

Miscellaneous applications of chromium steels and compounds.

23-252. Arc in the Barnyard. Robert West Howard. *Steelways*, July 1947, p. 16-19.

Varied uses of farm welding outfits.

For additional annotations indexed in other sections, see:
3-167-172-174-177-187; 6-155; 7-264-275; 9-74; 19-212-219; 20-375-396; 22-306-307-310-328-352-357-362; 27-126-141-151.



24-175. Study of Dryer Operation to Determine Cause of Failures. H. M. Spring. *Paper Trade Journal*, v. 124, May 29, 1947, p. 104, 106, 108, 110.

Failures of cast-iron paper-mill dryer rolls. Use of stress-analysis techniques to determine the presence of dangerous stresses.

24-176. Coring: Its Influence on Die Casting Design. *Die Castings*, v. 5, June 1947, p. 24, 26, 43-45.

(Turn to page 46)

"Locked-In" Stresses Incurred in Processing Important to Designer

Reported by Ray E. Cross

Chief Metallurgist, Michigan Light Alloys

Metallurgical factors in the processing of steels were covered by H. W. McQuaid, well-known consulting metallurgist, at the May meeting of the West Michigan Chapter. Mr. McQuaid outlined a metallurgist's position in an organizational setup and his relation to management, production and engineering. He must, of necessity, be an engineer—or at least familiar with engineering principles—to analyze and determine the reasons for failures in the field. Oftentimes a metallurgist is blamed for poor quality material, when inherently it is a design problem.

Numerous examples were cited of "locked-in" stresses that occur in fabrication processes such as casting, welding, heat treating, quenching, and straightening, and cause failure in such parts as axles and crankshafts. Too often, the design engineer considers only the service stresses, when investigation shows that a larger stress is incurred in some fabricating process such as straightening than in actual service.

The importance of biaxial and triaxial stresses is often overlooked in both the design of a section and analysis of the failure. Material having 30% elongation and 60% reduction in area, when subjected to triaxial stresses, may behave as a very brittle material. Definite variation in stress distribution of aluminum-killed as compared to regular steel has been demonstrated, yet how many designers take advantage of that fact? Mr. McQuaid questioned.

Variations in quenching techniques may often make the difference between satisfactory and unsatisfactory service because of resulting differences in "locked-in" tensile and compressive stresses. Most companies now avail themselves of the improved fatigue strength imparted by shot-peening the surface, which changes the stress distribution. Modulus of elasticity is an unknown factor to most engineers and metallurgists and one that cannot be overlooked, Mr. McQuaid warned.

Fatigue Life Increased By Shot-Peening, Rolling, Heat Treating

Reported by William McCrabb

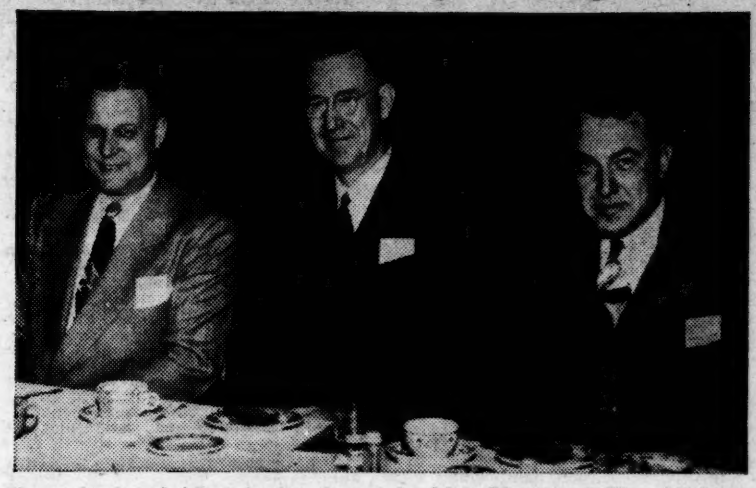
Dayton Rust Proof Co.

Improved design, combined with modern processing methods, is enabling our transportation system to carry greater loads at higher speeds without increasing the weight of the rolling stock, O. J. Horger, chief engineer of the railway division, Timken Roller Bearing Co., told the Dayton Chapter at its last meeting of the season.

Speaking on "Metallurgy and Design", Dr. Horger told how fatigue life can be increased by raising the endurance strength of the steel by one of three methods, namely, shot-peening, rolling at localized stress areas, or heat treatment. Endurance limit of a shaft has been raised by shot-peening from 15,000 to 43,000 psi., he said. Rolled threads are responsible for raising endurance limit 2½ times by the empressed compressive stresses.

Rolling of railroad wheel tires has reduced failures caused by stresses on the inside of the tire. Railroad car and locomotive axles are now undercut and rolled at the point beside the wheel where the stress formerly was concentrated. This modification in shaft design is responsible for a 68% increase in fatigue life without any increase in the weight of the part.

Speaks on Metallurgical Design



Harry McQuaid (Center), Speaker at the May Meeting of West Michigan Chapter, Is Flanked on the Left by Chapter Chairman Roy Nelson, and on the Right by William Jabsen, Current Vice-Chairman and Newly Elected Chairman

Use of cores to save metal and machining and to produce better castings.

24-177. Stress Investigations of Flat Welded-In Heads. H. M. Spring, Jr. *Mechanical Engineering*, v. 69, June 1947, p. 482-484.

Experiments on strain-gage, fatigue-endurance, and deflection-to-destruction techniques on a flat-head vessel constructed in accordance with the A.S.M.E. code for unfired pressure vessels indicate that the pressures allowed by the code are excessively conservative.

24-178. Large Deflections of Circular and Square Plates. H. D. Conway. *Philosophical Magazine*, v. 37, Nov. 1946, p. 756-767.

A mathematical analysis.

24-179. The Large Deflections of Rectangular Membranes and Plates. H. D. Conway. *Philosophical Magazine*, v. 37, Nov. 1946, p. 767-778.

A mathematical analysis.

24-180. Proof Loading—An Essential Non-Destructive Test. John C. New. *Industrial Radiography & Non-Destructive Testing*, v. 5, Spring 1947, p. 37-40.

Application of proof loading to a torpedo suspension band which must have enough elasticity to respond to changes in dimensions of the torpedo caused by presence or absence of 2800 psi. Both Stresscoat and the wire-resistance strain gage were used in stress analysis of the band.

24-181. Pressure Tubing for High Temperatures. *Mechanical Topics*, v. 10, Spring 1947, p. 6.

Chart for determining proper tube sizes and materials.

24-182. Stress-Strain Tester for Shaped Diamond Tools. *Industrial Diamond Review*, v. 7, May 1947, p. 135.

A brief description of the above device.

24-183. The Construction of Large Accurate Involute Curves. Part II. C. Attwood. *Machinery (London)*, v. 70, May 29, 1947, p. 561-564.

Methods used in gear-tooth design.

24-184. Stress Analysis. *Metal Industry*, v. 70, May 30, 1947, p. 399-400.

Utilization of plane-polarized light in study of plastic models of machinery components to check design serviceability and safety before beginning production.

24-185. The Importance of Pre-Spring Engineering. *Mainspring*, v. 12, June 1947, p. 2-5.

Example shows the importance of making design calculations before picking a spring for a job.

24-186. Analysis of Stresses in Unsymmetrical Pipe Frame. Jesse Yeakel. *Petroleum Refiner*, v. 26, June 1947, p. 113-115.

As a sequel to an article in the March issue, solutions are developed for two frames of somewhat more complicated shape than the U-bends discussed in the former article.

24-187. Car Frame and Crankcase Improved by Brittle Coating Tests. *Automotive Industries*, v. 97, July 1, 1947, p. 31, 60.

Use of Stresscoat by Packard to locate the weak spots in convertible bodies and also in the crankcase section of the eight-cylinder engine.

24-188. Designing Tools for Screw Machine Production. Part X. *Screw Machine Engineering*, v. 8, June 1947, p. 55-57.

Insert tools, two-piece tools, grinding arbor, grinding gage for sharpening, and corrected tool diameters for angles and radii.

24-189. Photo-Elastic Stress Analysis. *Aircraft Production*, v. 9, June 1947, p. 232.

Use of polariscope and transparent test specimens.

24-190. Diaphragm Control Valves. Arthur J. Koch. *Chemical Engineering*, v. 54, June 1947, p. 207, 208, 210, 212, 214, 216, 218.

Construction materials and designs for corrosive and high-temperature service in the chemical industries.

24-191. Problems in the Mechanical Design of Gas Turbines. Ronald B. Smith. *Journal of Applied Mechanics*, v. 14 *(Transactions American Society of Mechanical Engineers*, v. 69), June 1947, p. A99-A102.

A method of approach which has been successfully applied by the Elliott Co., Jeannette, Pa. Designs are based on the maximum-stress theory of failure, and the evaluation of working stress is made on the basis of the stress-to-rupture test in simple tension at elevated temperatures.

24-192. Correlation of Tension Creep Tests With Relaxation Tests. E. P. Popov. *Journal of Applied Mechanics*, v. 14 *(Transactions American Society of Mechanical Engineers*, v. 69), June 1947, p. A135-A142.

A satisfactory estimate of a relaxation graph may be obtained from the usual tension-creep curves. Validity of the method is demonstrated on the basis of experimental agreement between calculated and test results. 16 ref.

24-193. Combined-Stress Tests on 24S-T Aluminum-Alloy Tubes. W. R. Osgood. *Journal of Applied Mechanics*, v. 14 *(Transactions American Society of Mechanical Engineers*, v. 69), June 1947, p. A147-A153.

Tests were made on five 24S-T aluminum-alloy tubes, 1¾ in. i.d. × 0.05 in. thick. The ratios of circumferential (hoop) stress to axial stress were 0, ½, 1, 2, and infinity. Results are presented in the form of two sets of stress-strain curves for each ratio of stresses, namely, maximum shearing stress plotted against maximum shearing strain, and octahedral shearing stress plotted against octahedral shearing strain.

24-194. Buckling Under Locally Hydrostatic Pressure. B. J. Aleck. *Journal of Applied Mechanics*, v. 14 *(Transactions American Society of Mechanical Engineers*, v. 69), June 1947, p. A163-A164.

Discusses paper by G. H. Handelman, published in Sept. 1946 issue. Analysis is extended to the case where an end load is present in addition to locally hydrostatic pressure.

24-195. Concentrated-Force Problems in Plane Strain, Plane Stress, and Transverse Bending of Plates. J. J. Polivka. *Journal of Applied Mechanics*, v. 14 *(Transactions American Society of Mechanical Engineers*, v. 69), June 1947, p. A164-A165.

Brief discussion of paper by P. S. Symonds, published in Sept. 1946 issue.

24-196. Calculation of Stress in Crane Hooks. A. O. Gates. *Journal of Applied Mechanics*, v. 14 *(Transactions American Society of Mechanical Engineers*, v. 69), June 1947, p. A165.

Brief discussion of paper by A. M. Wahl, published in Sept. 1946 issue.

24-197. General Stress-Strain Laws of Elasticity and Plasticity. William Prager. *Journal of Applied Mechanics*, v. 14 *(Transactions American Society of Mechanical Engineers*, v. 69), June 1947, p. A168.

Discusses paper by A. Gleyzal, published in Dec. 1946 issue.

24-198. Designing of "Trouble-Free" Dies. Part LXX. Assembling Studs in Crank-Arms. C. W. Hinman. *The Modern Industrial "Press"*, v. 9, June 1947, p. 20, 34.

Dial-feed press tool automatically stakes round stud on crank arm.

24-199. Bimetal Casting Used in Auto Camshaft. *Iron Age*, v. 159, June 12, 1947, p. 51.

British-built Ford motor utilizes a separate casting for the gear with 1.3% C, plus Si-Cr alloy material, which is cast with two crossbars through the center. The bushing is then heat treated to a Brinell hardness of 187 to 241 for machinability. Finally, gray iron is poured into the center of the bushing and is fixed in place by the two crossbars.

24-200. Notch Effects in High Strength Aluminum Alloys. *Iron Age*, v. 159, June 12, 1947, p. 52-56.

Relative notch sensitivities of aluminum alloys 14S-T, 24S-T, and 75S-T were evaluated. Results are presented from the standpoints of both stress and strain notch sensitivity. Effects of holes in large structural members.

24-201. Calculations Improve Shrink Fits on Large Gears and Wheels. N. W. Sawin. *American Machinist*, v. 91, June 19, 1947, p. 142, 144-145.

Calculations and measurements made at the Skoda Works, during 1942 and 1943, in the course of the manufacture of several pairs of heavy driving gears for rolling mills.

24-202. Developments in Casing Standards and Design. John Wais, Jr. *Petroleum Engineer*, v. 18, June 1947, p. 106, 108, 111.

Thread design, effect of notching and flattening, high-pressure testing, calculation of stresses, and design of high-strength casing joints in oil-well casing.

24-203. Arc Welded Structural Steelwork. *Transactions of the Institute of Welding (BWRA Supplement)*, v. 10, April 1947, p. 26-29.

Recommendations for the design, fabrication, and erection of welded stanchion bases, caps, and joints.

24-204. Numerical Methods for the Calculation of Elastic Instability. Bruno A. Boley. *Journal of the Aeronautical Sciences*, v. 14, June 1947, p. 337-348; discussion, p. 348-350.

Three numerical methods for the evaluation of buckling loads requiring an operations table similar to that used in Southwell's relaxation procedure. The procedure to be followed in each method. Experiments on sheet and stringer combinations, the results of which are in good agreement with those obtained from each of the three methods of calculation.

24-205. Considerations Involved in the Accurate Development of Templets. (Continued.) A. Dickason. *Sheet Metal Industries*, v. 24, June 1947, p. 1193-1196, 1201.

A number of calculation methods for aircraft parts. Includes diagrams. (To be continued.)

24-206. Welded Bases for Metal Processing Equipment. *Materials & Methods*, v. 25, June 1947, p. 130-131.

Advantages of the above. (Condensed from *Machines et Metaux*, v. 31, Jan. 1947, p. 3-7.)

24-207. Welded Brake Straps for Excavators. William C. Black. *Welding Journal*, v. 26, June 1947, p. 494-496.

The application of scientific methods to the redesign of a brake strap used on open-pit mining shovels, to change from riveted to welded construction.

24-208. Arc Welded Steel Construction Improves Production of Meat Packing Machinery. R. H. Davies. *Welding Journal*, v. 26, June 1947, p. 514.

Design of welded saddles for dry-rendering cooker.

24-209. Mixed Boundary Conditions in the Relaxational Treatment of Biharmonic Problems (Plane Strain or Stress). L. Fox. *Proceedings of the Royal Society*, v. 189, June 3, 1947, p. 535-543.

Relaxation methods already have been applied to the solution of four problems. Here the method is adapted to the case in which the two types of boundary condition are mixed, where photoelastic methods are difficult to apply. Two examples are treated by relaxation methods. Results obtained indicate that this method may be a valuable alternative in engineering problems.

24-210. The High-Pressure Gasholder. M. Noone and A. G. Grant. *Gas Times*, v. 51, June 14, 1947, p. 376-379.

(Turn to page 48)

Electrical & Aircraft Industries Use Beryllium Copper

Reported by Frank Kristufek

U. S. Steel Corp. Research Laboratory

Increased use of electronically actuated devices for automatic control of many industrial processes has greatly multiplied the postwar applications of beryllium copper, according to Harold G. Williams, chief metallurgist for the Instrument Specialties Co. During his address on "Strong Copper Alloys" before the New Jersey Chapter ●, Mr. Williams discussed various copper-base alloys but devoted most of his talk to beryllium copper.

Alloys of beryllium and copper have been on the market in the United States since 1931, stated the speaker. They are characterized by a combination of high strength and hardness, excellent fatigue resistance, and high wear resistance; they possess the noncorrosive properties of copper. Such alloys can be soft soldered, silver soldered or welded and plated.

An interesting sidelight is that although the copper, brass, and bronze industries were developed to a high degree during the Roman era, the so-called "lost art of hardening or tempering copper" presumably developed by the ancients is merely a myth and no specimens of ancient tools that have been tested by scientific methods ever approached in hardness the values that can be obtained with modern heat treated beryllium-copper alloys.

Beryllium-copper products formed by cold working do not require a solution heat treatment before hardening but those which have been formed by hot working or which have been welded or hard soldered must be solution annealed before they will respond satisfactorily to precipitation hardening. Such hardening is done at 600 to 700° F. after the part has been formed, and develops tensile values as high as 190,000 psi. and hardness values as high as Rockwell C-40.

Beryllium copper, according to Mr. Williams, has excellent characteristics for many applications in the electrical and aircraft industries, especially where it is impossible to use steel. This alloy is ideal for pressure applications and for parts such as springs, gears, diaphragms, bearings, and other articles where excellent electrical conductivity, corrosion resistance, nonmagnetic properties, machinability, and ductility are required.

Case School Changes Name

The name of Case School of Applied Science, Cleveland, was officially changed on July 1 to Case Institute of Technology. The change has been made in order to describe more accurately the entire field of activities that this engineering college occupies.

NATIONAL MEETINGS

for September

Sept. 1-4 — American Society of Mechanical Engineers. Fall Meeting, Hotel Utah, Salt Lake City, Utah. (George Aubrey Hastings, Director of Public Relations, 1 Madison Ave., New York 20.)

Sept. 8-12 — Instrument Society of America. Second National Instrument Conference and Exhibit. Stevens Hotel, Chicago. (I.S.A., 1117 Wolfendale St., Pittsburgh 12.)

Sept. 10-12 — Porcelain Enamel Institute. Ninth Annual Forum, Ohio State University, Columbus, Ohio. (Industrial News Service, 526 Oliver Bldg., Pittsburgh 22.)

Sept. 17-18—Society of Automotive Engineers. Tractor Meeting, Hotel Schroeder, Milwaukee, Wis. (John A. C. Warner, secretary, 29 West 39th St., New York 18.)

Sept. 17-26 — National Machine Tool Builders' Association. Machine Tool Show, Dodge-Chicago Plant, Chicago. (N.M.T.B.A., 10525 Carnegie Ave., Cleveland 6.)

Sept. 18-20 — National Association of Foremen. 24th Annual Meeting, Biltmore Hotel, Los Angeles. (N.A.F., 321 West First St., Dayton 2, Ohio.)

Sept. 22-25 — Association of Iron and Steel Engineers. Annual Meeting, Hotel William Penn, Pittsburgh. (T. J. Ess, managing director, Empire Bldg., Pittsburgh 22.)

Design, construction, and testing of holders with 6000 to 500,000 cu.ft. capacities and maximum working pressures of 40 to 200 psi.

24-211. Stress Analysis of Passenger Cars. K. F. Nystrom. *Railway Age*, v. 122, June 27, 1947, p. 1294D220-1294D229.

A stronger and lighter car than the present A. A. R. recommended design can be built.

24-212. How to Avoid Failures of Brass Due to Season Cracking. *Electrical Manufacturing*, v. 40, July 1947, p. 100-103, 186, 188, 190.

Season and stress-corrosion cracking can be avoided by selection of materials, proper working and annealing, and control of service conditions.

24-213. Welded Buildings From Used Pipe. *Linde Tips*, v. 26, July 1947, p. 87-88.

Design and construction of low-cost structures.

24-214. Wood-to-Metal Adhesives. Thomas D. Perry. *Plastics*, v. 7, July 1947, p. 21-22, 24, 68.

Applications and properties of plywood-metal laminates. Design details.

24-215. Temporary Tooling for Metal Luggage. *Tool & Die Journal*, v. 13, July 1947, p. 88, 90, 94, 95, 106C.

Special design for magnesium-sheet luggage, using brake equipment.

24-216. Stress Determination by Brittle Coatings. Greer Ellis. *Mechanical Engineering*, v. 69, July 1947, p. 567-571.

24-217. Electromagnetic Vibration Exciter and Calibrator. *Product Engineering*, v. 18, July 1947, p. 92-94.

Details of an exciter for dynamic stress analysis covering low and high-frequency ranges.

24-218. Redesign for Projection Welding Speeds Stamping Assembly. *Product Engineering*, v. 18, July 1947, p. 95.

Bosses for projection welding serve as locater pins to position parts in welding of redesigned roller skate.

24-219. Special Fasteners Cut Assembly Time. *Product Engineering*, v. 18, July 1947, p. 96-98.

Use of 44 sheet-metal fasteners of 14 different types to assemble the Motorola gasoline car heater.

24-220. Vibration Testing Technique and Its Use in Improving Designs. John A. Dickie. *Product Engineering*, v. 18, July 1947, p. 115-119.

Use of shake testing to check the dynamic behavior of machines and structures at operating conditions. Forced-vibration methods for determining the fatigue strength of individual parts.

24-221. Nomogram for Polar Moment of Inertia by Suspension. Herbert F. Bariff. *Product Engineering*, v. 18, July 1947, p. 177.

How to determine polar moment of inertia for an irregular mass by experimental measurements plus use of nomogram.

24-222. Stress Analysis by X-Ray Diffraction. Herbert R. Isenburger. *Machinery*, v. 53, July 1947, p. 167-168.

Back-reflection method is only means of accurately analyzing existing stresses without measuring unstressed structure.

24-223. Speed Reducer With Wabble-Gear Mechanism. A. W. Jansson. *Machinery*, v. 53, July 1947, p. 178-180.

Mechanism used to drive tumbling barrels and similar equipment.

24-224. How to Design Carbide Blanking Dies. Earle Glen. *American Machinist*, v. 91, July 17, 1947, p. 137-139.

Advantages of carbide blanking dies and reasons for these advantages. Methods of attaching carbide die section. Other design considerations.

For additional annotations indexed in other sections, see:
9-76; 12-116; 14-172-176; 19-193-205-223; 20-336-379; 21-66; 22-305-324-338; 27-117-119-124-126-128-129-142-143-144-147-150-151.

25 MISCELLANEOUS

25-92. Physical Burden Reduced in New Cadillac Foundry. Frank M. Scotten. *Production Engineering & Management*, v. 19, June 1947, p. 51-55.

Materials-handling and plant layout.

25-93. Materials Handling—A Profit Factor. R. W. Mallick and J. H. Sansanetti. *Steel Processing*, v. 33, June 1947, p. 341-344.

Value of using improved methods for the above and for plant layout illustrated by examples from experience at Westinghouse.

25-94 British Laboratory for Physical Metallurgy. Tom Bishop. *Metal Progress*, v. 51, June 1947, p. 960-961.

Work to be done by sections on general physics, instruments, heat and thermodynamics.

25-95. Forging Production Readings Provided by Combustion Safeguard. *Steel*, v. 120, June 23, 1947, p. 112.

How photo-electric eye circuit counts forging production. Such units are usually used to shut off fuel when combustion fails.

25-96. How Mechanization Has Helped Sibley Foundry. *Link-Belt News*, v. 14, June-July 1947, p. 1, 5, 7.

Materials-handling procedures in gray-iron foundry of Sibley Machine & Foundry Corp., South Bend, Ind.

25-97. Engineering Shop Notes. *Materials & Methods*, v. 25, June 1947, p. 136-137.

Projection welding of cabinet latches cuts assembly cost, by Wallace A. Stanley. Brush plating for small jobs, by George Black. Heat treating fixture for cyanide bath, by C. E. Garwood. Plastic blanket for chromium plating baths. Broaching 20 notches in one operation.

25-98. The Office of Naval Research. H. G. Bowen. *Welding Journal*, v. 26, June 1947, p. 489-493.

An address before the Joint Meeting of the American Society for Metals and the American Welding Society, Dec. 11, 1946, Washington, D. C.

25-99. Minerals for Chemical and Allied Industries: A Review of Sources, Uses and Specifications. Part XII. Sydney J. Johnstone. *Industrial Chemist*, v. 23, June 1947, p. 341-350.

Whiting (calcium carbonate) and lithium compounds. (To be continued.)

25-100. The Steel Industry Grows With the West. Ralph G. Paul. *Western Machinery and Steel World*, v. 38, June 1947, p. 80-93.

Brief description of history and present status of six Western steel plants (Geneva, Colorado Fuel & Iron, Fontana, Columbia, Bethlehem Pacific, and Western Steel).

25-101. Metalworking Industry Gets Real Benefit From Atomic Pile. Gene Hardy. *Iron Age*, v. 160, July 10, 1947, p. 108-110.

Operations of the Atomic Energy Commission in production and sale of isotopes for metallurgical uses. The uses of a few of the isotopes (carbon 14, sulphur 35, chlorine 36, calcium 35, titanium 51, and iron 59) in metallurgical research.

25-102. Effective Layout and Handling Mean Lower Costs, More Production. Harry S. Wharen. *American Machinist*, v. 91, July 17, 1947, p. 114-115.

How switchbox production at Square D benefits from straight-line flow and fast conveyerized handling.

For additional annotations indexed in other sections, see:
8-101-103.

26 STATISTICS

26-82. The Container Industry. *Index*, v. 27, Summer 1947, p. 36-46.

Wartime developments and production and consumption statistics.

26-83. Italian Iron and Steel. Antonio Giordano. *Iron and Steel*, v. 20, May 23, 1947, p. 205, 280.

The position of the industry during 1946. Production statistics for past ten years.

26-84. Interior Department Revises Mineral Reserve Estimates. *Engineering and Mining Journal*, v. 148, June 1947, p. 80-83.

Report prepared by Bureau of Mines and Geological Survey, and not yet available to public, includes a graphical presentation of the more important data.

26-85. Vibrating Screen Estimation. H. L. Bullock. *Chemical Engineering*, v. 54, June 1947, p. 97-99.

Curves facilitate cost estimation.

26-86. See $20 Million Machine Tool Sales to Latin America in 1947. Gene Hardy. *Iron Age*, v. 159, June 19, 1947, p. 119-122.

Phenomenal gain is indicated due to available exchange and current demand.

26-87. Official Discloses Statistics on Future British Steel Needs. *Iron Age*, v. 159, June 19, 1947, p. 123, 160, 162-165.

Future plans until 1955.

26-88. Component Inventories, Shipments Unbalanced. *Steel*, v. 120, June 23, 1947, p. 69-71, 176.

Survey of metalworking companies shows relationships of inventories and deliveries for a variety of parts and finished products, both ferrous and nonferrous.

26-89. The Nonferrous Foundry Industry—Its Structure, Sales, Costs, and Profits. Part I. Joseph B. Meier and Virginia H. McClung. *Foundry*, v. 75, July 1947, p. 86-88, 138, 140.

Statistics of the commercial nonferrous foundry industry soon to be released by the Office of Temporary Controls, successor to the O.P.A. (To be continued.)

26-90. Economic Aspects in the Use of Aluminum and Magnesium Alloys. L. W. Eastwood. *Materials & Methods*, v. 25, June 1947, p. 63-68.

Compares properties and fabricating costs with those for cast iron and various steels. Favorable characteristics must be balanced against a somewhat higher cost of fabrication.

26-91. Steel Development Plan. Part I. R. W. Shone. *Iron and Steel*, v. 20, June 1947, p. 321-324.

Estimation of the future demand for steel in Britain in connection with plans for nationalization of the industry. (Paper presented to Royal Statistical Society. To be concluded.)

26-92. Iron Ore Supply for the Future. William O. Hotchkiss. *Economic Geology*, v. 42, May 1947, p. 205-210.

Stockpiling is recommended for iron ore, scrap, pig iron, as well as for

(Turn to page 60)

5-Year Certificates Given to Old-Timers

Left: Arthur T. Clarage, Master of Ceremonies; and Right: A. T. Bush, Recipient of a Certificate

Reported by M. J. Vandenberg

Park Chemical Co.

Over 200 Chicago Chapter members ok occasion at the May meeting to nor the "Old-Timers". At that time members were awarded a silver rtificate in recognition of 25 years continuous membership. They were so given a 25-year gold pin by the hicago Chapter.

A. T. Clarage of Columbia Tool Steel o. acted as master of ceremonies. rtificates and pins were presented A. S. Jameson, International Harster Co., 1947-1948 chapter chairman. e was assisted by H. L. Geiger, the tgoing chairman, and J. Kubik, enrtainment chairman.

Brief talks on the growth and purses of the A.S.M. were given by H. ardwicke of Latrobe Steel Co., reed, H. B. Knowlton, International arvester Co., and H. F. Wood, Wyan Gordon Co. The speaker of the ening was M. A. Grossmann, past esident and director of research r Carnegie-Illinois Steel Corp. He as introduced by Technical Chairman Simon of Electro-Motive Division, eneral Motors Corp., and presented a ry interesting talk on "Science".

Those who received 25-year certifites and pins are:

T. F. Birmingham, H. K. Briggs, A. Bush, H. L. Campbell, W. H. C. Carrt, A. T. Clarage, E. M. Converse, F. Courtright, F. S. Crane, Wm. inkl, R. G. Glass, C. S. Gordon, E. J. osett, M. A. Grossmann.

H. Hardwicke, J. Hulting, P. C. untly, E. T. Jackman, E. J. Janitzky, A. Klein, Jr., H. B. Knowlton, E. rned, D. Levinger, Wm. J. Macenzie, C. A. Martin, W. R. Mau, J. H. ead, B. Neunert, Nils T. Nilson, J. Obermaier.

H. N. Parsons, E. Pierce, F. Sailer, Schmalz, Fred A. Snow, A. M. ower, J. C. Thompson, A. Walcher, D. Weed, F. Wheeler, Harold F. ood, Otto Waarich, B. Williams, L. I. oomans, E. R. Young, G. Ziv.

Addresses of Manufacturers

(Continued from page 21)

Lincoln Electric Co. (R-851)
Cleveland 1, Ohio

Machlett Laboratories (R-875)
Springdale, Conn.

Magnaflux Corp. (R-835)
5900 Northwest Highway
Chicago 31, Ill.

Mallory & Co., P. R. (R-843)
Indianapolis 6, Ind.

Milwaukee Metal Spinning Co. (R-848)
4122 W. State St.
Milwaukee 8, Wis.

Munton Mfg. Co. (R-872)
Franklin Park, Ill.

National Research Corp. (R-866)
Cambridge 42, Mass.

Parker Mfg. Co. (R-850)
2200 Colorado Ave.
Santa Monica, Calif.

Permanente Metals Corp. (R-883)
Kaiser Bldg.
Oakland 12, Calif.

Physicists Research Co. (R-836)
343 S. Main St.
Ann Arbor, Mich.

Pullman-Standard Car Mfg. Co.
Chicago, Ill. (R-853)

Racine Steel Castings Co. (R-849)
Racine, Wis.

Ransburg Co., Harper J. (R-861)
Barth & Sanders
Indianapolis 7, Ind.

Revere Copper and Brass, Inc.
230 Park Ave. (R-893)
New York 17, N. Y.

Reynolds Metals Co. (R-884, 885, 886, 887)
2500 S. Third St.
Louisville 1, Ky.

Rigid-Tex Corp. (R-841)
Buffalo 3, N. Y.

Salkover Metal Processing (R-857)
321 Dixie Terminal Bldg.
Cincinnati 2, Ohio

Solar Aircraft Co. (R-847)
2200 Pacific Highway
San Diego 12, Calif.

Statham Laboratories (R-833)
Los Angeles, Calif.

Superior Steel Corp. (R-842)
Carnegie, Pa.

Tinnerman Products, Inc. (R-878)
2026 Fulton Rd.
Cleveland 13, Ohio

Tube Turns, Inc. (R-862)
Louisville 1, Ky.

Vanadium-Alloys Steel Co. (R-839)
Latrobe, Pa.

Welding Equipment & Supply Co.
223 Leib St. (R-854)
Detroit 7, Mich.

Westcraft, Inc. (R-888)
Los Angeles, Calif.

Westinghouse Electric Corp
306 Fourth Ave. (R-840, 846)
Pittsburgh 30, Pa.

other ores and metals, as a security measure.

26-93. The World Situation on Coating Materials—Lead, Zinc and Tin. C. A. Ilgenfritz. *Western Metals*, v. 5, June 1947, p. 20-21.

26-94. United States Mine Producers Are Able to Meet Future Domestic Copper Requirements. Louis S. Cates. *Metals*, v. 17, June 1947, p. 6-8, 19.

President of Phelps-Dodge Corp. believes that industry will need re-establishment of tariff at proper time; expects normal requirements to be 850,000 tons a year.

26-95. Price Recession in Lead in Fourth Quarter Deemed Likely as Supply Balances Demand. Irwin H. Cornell. *Metals*, v. 17, June 1947, p. 9-12.

26-96. Urges Creation of National Stockpile of Copper of Not Less Than One Million Tons. C. Donald Dallas. *Metals*, v. 17, June 1947, p. 13-17.

Chairman of board of Revere Copper and Brass doubts whether domestic output will suffice to meet needs 22 months from now when 4% tariff again becomes effective.

26-97. London Metal Trade is Uneasy on Outlook; All Fabricators Are Booked Well Ahead. L. H. Tarring. *Metals*, v. 17, June 1947, p. 18-19.

26-98. The Italian Pig-Iron and Steel Industry. H. J. Becker. *Foundry Trade Journal*, v. 82, June 12, 1947, p. 137-138.

Statistics and economics.

26-99. Our Tin Supply: 1947-1948. *Glass Packer*, v. 26, July 1947, p. 503-505.

The war's over—so why is there still a shortage of tin and tinplate? Why should controls be continued? What are prospects for next year? Official facts and figures, plus a careful analysis, supply the answers as fully as they can be known at present.

26-100. Copper Mining Firms and Their Metals. David N. Skillings. *Skillings' Mining Review*, v. 36, July 12, 1947, p. 1, 13.

1946 production statistics for 22 copper mining companies.

For additional annotations indexed in other sections, see:
27-122-139-141.

27 NEW BOOKS

27-117. The Blueprint Language. Henry Cecil Spencer and Hiram E. Grant. 255 p. Macmillan Co., 60 Fifth Ave., New York 11, N. Y. $5.00.

Emphasizes visualization of views of objects. Work sheets at the end of each chapter provide the student with training in making mechanical drawings. The last chapter includes a large number of commercial blueprints, carefully selected to bring out a variety of principles and practices. A chapter on shop processes is provided for those whose experience may be limited. This chapter explains briefly the forming of metals, forging, and casting, as well as basic machine-tool operations. (From review in *Machinery*, v. 53, July 1947.)

27-118. Control Charts in Factory Management. William B. Rice. John Wiley and Sons, Inc., 440 Fourth Ave., New York 16, N. Y. $2.50.

After a few introductory chapters on statistical control and the role of inspection, the main substance is contained in three chapters. The first deals with charts for variables in which quality is described quantitatively in terms of dimensions, weights, or other characteristics. The second deals with charts for attributes, in which inspection is visual or by "go and no-go" gages. Then follows a chapter giving a number of illustrative case histories. Finally, there is a chapter on the organization of a statistical quality-control program.

27-119. Ferrous Metallurgical Design. John H. Hollomon and Leonard D. Jaffe. 346 p. 1947. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. $5.00.

This book is not devoted to design of parts or structures, or to stress analysis, but rather to the application of scientific principles to the selection of metals and alloys for specific applications, and also to the selection of heat treating procedures to develop the required properties. In order to do this it is necessary to have a knowledge of phase transformations, heat flow, mechanical properties, quenching and quench cracking, hardenability, and temperability. These topics are covered in separate chapters, followed by two chapters on their application to design. 317 ref.

27-120. Stainless and Heat Resisting Steels—Simply Explained. Edwin Gregory and Eric N. Simons. Hutchinson's Scientific and Technical Publications, Ltd., 47 Princes Gate, London, S.W. 7, England. 8s, 6d.

Deals with a wide range of stainless and heat resisting steels. A simple explanation of the mechanism of corrosion, erosion, and creep, followed by the commercial methods of manufacture of the stainless steels. The next section covers the various steels and irons themselves; how to handle these steels in many different ways. Stainless-clad materials and stainless steel castings. Notes on testing, inspection, applications, useful charts, tables, and diagrams.

27-121. Aluminum Alloy Castings—Their Founding and Finishing. E. Carrington. Charles Griffin & Co., Ltd., 42 Drury Lane, London, W.C.2, England. 25s.

Elementary text is kept at the level of the "practical" man. Cost estimation; die making; sand control; molding; sand casting; heat treatment.

27-122. Quin's Metal Handbook and Statistics, 1946. F. B. Rice-Oxley, compiler. 424 p. Metal Information Bureau, Ltd., Princes House, 39 Jermyn St., London, S.W.1, England. 12s, 6d, post free.

33rd edition of this reference work incorporates a great deal of information that was not available, for security reasons, during the war years. Details of United Kingdom imports and exports for the years 1940-44 are given, together with statistics on British iron and steel and ferro-alloy production. A new feature is a summary of the white paper on the British Iron and Steel Federation's report on plans for the modernization of the British iron and steel industry. (From review in *Mining Magazine*, v. 76, June 1947.)

27-123. The Welding Encyclopedia. 12th Edition. T. B. Jefferson. 1024 p. McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y. $6.50.

An up-to-date treatment of every subject which deals with welding, cutting or related processes. In this edition 300 pages of material of the previous edition are replaced to take care of advances made in welding during the war. The book contains five sections, the first of which is an encyclopedia of welding. This is followed by an appendix containing tables and charts, a dictionary of trade names, a buyers' manual, and an index with cross references. (From review in *Iron Age*, v. 159, June 19, 1947.)

27-124. Applied Engineering Mechanics. Alfred Jensen. 316 p. McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y. $3.00.

Text is suitable for college students in engineering and architecture and for those in junior colleges and technical institutes. The first part is voted to statics and the second dynamics. To aid the student, more abstract mathematical relationships have been minimized in favor strong emphasis on the physical cepts. Problems are given more usual emphasis. Analytical graphical solutions are given side side. (From a review in *Power*, v. June 1947.)

27-125. Materials of Industry. Edition. Samuel Foster Mersereau. vised by Calvin G. Reen and Ken L. Holderman. 632 p. McGraw-Book Co., Inc., 330 W. 42nd St., York 18, N. Y. $2.80.

Industrial materials widely used day, such as petroleum, concr glass, alloy steels, magnesium, thetic rubber, and plastics.

27-126. Servomechanism Fundamen H. Lauer, R. Lesnick, and L. E. Mat 277 p. McGraw-Hill Book Co., Inc. W. 42nd St., New York, N. Y. $3.50

Detailed derivations are made the basic properties of servocon devices and their relation to the ph ical principles that govern their op ation. Several examples, exerci and problems of a practical nat are given, together with formu curves and diagrams needed for th solution. (From review in *Power*, v. June 1947.)

27-127. Theory of Metallurgical Pr esses. S. T. Rostovtsev. 307 p. S Scientific Publishing House for Ferr and Nonferrous Metallurgy, Mosc Russia. (In Russian.)

Emphasizes the thermodynamic vestigation of metallurgical reactio Since the investigation of the kine of metallurgical processes is in its tial stages, the author introduces own theories and methods of solvi for a series of problems on some the simpler metallurgical processes, cluding the application of physi chemistry to metallurgical proces combustion theory, the system Fe oxygen, slag properties and syste reduction theory, oxidation smelti and desulphurization and depho phorization of metals.

27-128. Practical Mechanics for Leroy E. Beaufoy, Editor. 448 p. Odh Press Ltd., Long Acre, London, Engl 9s, 6d.

Consists of fourteen chapters written by a separate authority the mechanics of equilibrium; for in structures; the mechanics of mo ment; friction and lubrication; pr tical mechanisms; forms of ener strength of materials; properties materials; machine principles and sign; mechanics of fluids; hydra machinery; testing and driving m chines; mechanics of flight. (Fr review in *Machinery (London)*, v. May 8, 1947.)

27-129. Standard Specifications for We ing Highway and Railway Bridg Design, Construction and Repair. Fou Edition. 102 p. American Welding S ciety, 33 W. Thirty-Ninth St., New Y 18, N. Y. $1.00.

An extended discussion of a n concept in design formulas. In t concept the formulas are prescri for both base material and wel connections according to the expec number of repetitions of loading wh would produce the maximum stress a member. The section on mate has been revised to provide for m general use of A7 steel, and the sec on inspection has been expanded include provision for magnetic-par testing, as well as X-ray and vi examination. (From review in *Ra way Age*, v. 123, July 19, 1947.)

27-130. X-Rays in Research and Ind try. Second Edition. H. Hirst. 12 Chapman & Hall, Ltd., 37 Essex Str W.C.2, London. 13s, 6d.

(Turn to page 52)

In view of the great amount of interest in the exhibition of micrographs at the last convention, it is natural that the

Second Metallographic Exhibit

will be held at the National Metal Congress and Exposition in Chicago, Oct. 18 to 24, 1947. The rules are simple and few; there are no restrictions as to size or method of mounting. A large area in the exhibition hall has been reserved so the entries can be displayed to best advantage.

RULES FOR ENTRANTS

Each photographic print shall be mounted on stiff cardboard, each on a separate mount. Each mount shall carry a label giving

Name of metallographer
Classification of entry
Material, etchant, magnification
Any special information as desired

Transparencies or other items to be viewed by transmitted light must be mounted on light-tight boxes wired for plugging into an ordinary lighting circuit, and built so they can be fixed to the wall.

Exhibits must be delivered on or before Tuesday, Oct. 14, 1947, preferably by prepaid express or registered parcel post.

Address:

Metallographic Exhibit,
National Metal Congress and Exposition
International Amphitheater
West 42nd and South Halsted St.,
Chicago, Ill.

CLASSIFICATION OF MICROGRAPHS

1. Cast Irons
2. Tool Steels (except carbides)
3. Irons and Steels (including stainless)
4. Light Metals and Alloys
5. Heavy Nonferrous Metals and Alloys
6. Powder Metals (and carbides) and Products
7. Weld Structures (including brazed and similar joints)
8. Surface Phenomena (including corrosion products and electroplates)
9. Series of Micros showing Transitions or Changes During Processing
10. Macrographs of Metallurgical Objects or Operations (10 diameters or less)
11. Results by Non-Optical or other Unconventional Techniques.

AWARDS AND OTHER INFORMATION

A committee of judges will be appointed by the Metal Congress management which will award a first prize (a blue ribbon) to the best in each classification. Honorable Mentions will also be awarded other photographs which in the opinion of the judges closely approach the winner in excellence.

A Grand Prize, in the form of an engrossed certificate, and a money award of $100 will be awarded the exhibitor whose work is adjudged "best in the show", and his exhibit shall become the property of the American Society for Metals for preservation and display in the Sauveur Room at the Society's Headquarters.

All other exhibits will be returned to owners by prepaid express or registered parcel post during the week of Oct. 27, 1947.

29th NATIONAL METAL CONGRESS

INTERNATIONAL AMPHITHEATER, CHICAGO

October 18 to 24, 1947

Based on a series of lectures, this book deals with X-ray technique in a concise and practical way. Problems in industry and research, particularly in metallurgy, receive special attention.

27-131. Report on Boron-Treated Steel. 72 p. Society of Automotive Engineers, Inc., 29 W. 39th St., New York, N. Y. $2.00.

Summarizes the contents of 19 reports submitted by 12 collaborators who participated in the testing program conducted during the war for the U. S. Army's Ordnance Dept. The program was designed to determine the following: the relative merits of 7 commercial boron-containing addition agents when added in varying amounts to a 0.45 to 1.50% Mn steel. The suitability of a boron-treated 0.45 to 1.50% Mn steel for an army truck part, and for other parts of ordnance equipment was determined by special laboratory and shop tests.

27-132. Review of Metal Literature, 1946. Volume 3. 811 p. American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. $15.00.

A compilation of the annotations published in *Metals Review* during 1946. Also includes a list of addresses of publications, an author index, and a subject index. Contains 5500 annotations and lists 275 English-language and 18 foreign-language periodicals as sources (other than books and miscellaneous publications).

27-133. The Structure of Cast Iron. Alfred Boyles. 154 p. American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. $3.25.

A series of three lectures on the structure of cast iron presented during the 28th National Metal Congress and Exposition, Atlantic City, Nov. 18 to 22, 1946. The lectures are limited to the structure of cast iron as determined by freezing and transformation. Intended for metallurgists familiar with steel, but not with cast iron. Attention is centered on alloys of hypoeutectic composition, and special alloying elements are excluded. Most of the experimental work described was done at Battelle Memorial Institute.

27-134. Ball and Roller Bearing Engineering. Arvid Palmgren. 270 p. S. H. Burbank & Co., 147 N. Tenth St., Philadelphia, Pa.

This is a fundamental text; it is neither a comprehensive treatise nor a bearing catalog. Emphasis is placed on fundamental principles rather than on specific problems. Derivations and calculations which require a knowledge of higher mathematics have been omitted wherever possible. (From review in *Automotive and Aviation Industries*, v. 96, June 1, 1947.)

27-135. Metallische Ueberzuege (Metallic Coatings). Second Edition. Willi Machu. 643 p. Becker & Erler Kom.-Ges., Leipzig, Germany. Reprinted by Edwards Brothers, Inc., Ann Arbor, Michigan. $15.50.

A section on corrosion, preparation of metallic objects for metal coating, manufacture of metal coatings by heat, mechanical and electrochemical processes. Each type of metallic coating is discussed in detail in the second section. (From review in *Aeronautical Engineering Review*, v. 6, April 1947.)

27-136. Symposium on Testing of Parts and Assemblies. 86 p. June 26, 1946. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. (Technical Publication No. 72.) $1.50.

The fatigue strength of lap joints in some magnesium sheet alloys, by H. J. Grover and L. R. Jackson. Automotive rear axles and means of improving their fatigue resistance, by O. J. Horger and C. H. Lipson, and accompanying discussion.

27-137. Protective Organic Coatings as Engineering Materials. Joseph J. Mattiello. 100 p. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

Raw materials, the various types of coatings, fundamental investigations, corrosion theory, surface preparation, applications (the largest section), testing, economics, and future trends. (Reprinted from *Proceedings of the American Society for Testing Materials*, v. 46, 1946.)

27-138. Grinding Wheels. 94 p. Mid-West Abrasive Co., Owosso, Michigan.

Various points of grinding wheel usage. Grinding wheel bond, structure, grade and grain size, recommended specifications in connection with the new standard wheel marking symbols. Notes on crush truing grinding wheels, centerless grinding of screw threads, and microbonded honing stones.

27-139. Illinois Mineral Industry in 1945. Walter H. Voskuil, Douglas F. Stevens and Nina T. Hamrick. 116 p. Illinois State Geological Survey, Urbana, Ill. (Report of Investigations No. 121.)

Statistics on coal, petroleum and gas, stone and rock products, clay and clay products, sand and gravel, silica and tripoli, fluorspar, zinc, lead, silver, miscellaneous minerals, and minerals processed but not mined in Illinois.

27-140. The Flotation Index. Volumes I and II. 88 p. Great Western Division, Dow Chemical Co., 310 Sansome St., San Francisco, Calif.

Volume I is a bibliography of articles, papers, reports, and books on the subject of flotation from 1928 through 1944, and volume II lists articles published in late 1944 and 1945. Includes patents, but no abstracts. Arrangement is by source, and there is no index.

27-141. Tungsten. K. C. Li and Chung Yu Wang. 430 p. Reinhold Publishing Corp., 330 W. 42nd St., New York 18, N. Y. $8.50.

This edition has been revised by addition of more recent material, particularly to the chapters on geology and industrial applications. Its history, geology, ore-dressing, metallurgy, chemistry, analysis, applications, and economics. Procedures for purchase of tungsten ores and a bibliography of articles on tungsten alloys.

27-142. Aircraft Strength of Materials. H. D. Conway. 256 p. Chapman and Hall, 37 Essex St., London, W.C.2, England. 21s.

A rapid survey of basic structural theory and a number of problems of particular interest to the aeronautical engineer.

27-143. Spring Design and Calculations. J. A. Roberts, compiler. Technical Research Laboratory. Herbert Terry and Sons, Ltd., Redditch, England. 10s, 6d.

The practical aspects of designing a spring to do its job efficiently.

27-144. Torsionssteifigkeit im Flugzeugbau verwendeter Systeme. (Torsional Stiffness of Wings.) Ilhan Nural. A. G. Gebr. Leeman & Co., Zurich, Switzerland.

An analysis of the behavior in torsion of a box system designed to represent an airplane wing structure, together with an account of some interesting related experiments.

27-145. British Standards for Workshop Practice. Revised Edition. J. E. Baty, editor. 483 p. British Standards Institution, 28 Victoria St., London, S.W.1, England. 12s, 6d to nonmembers.

Essential data and drawings relating to forty British Standards covering limits and fits; threads, nuts, bolts, screws and washers; small rivets; certain small tools; drilling-jig bushes; butt welded lathe and planer tools; keys and keyways; shaft tapers, splines and serrations; ball and roller bearings; and certain details of machine tools. Also includes data on cast iron and steel, wire gages and metric conversions.

27-146. Mathematical Methods of Statistics. Harald Cramer. 575 p. Princeton University Press, Princeton, N. J. $[illegible]

An introduction to the fundamental concept of a distribution and of integration with respect to a distribution. The general theory of random variables and probability distributions and the theory of sampling, statistical estimation, and tests of significance.

27-147. Surface Stressing of Metals. 197 p. American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. $4.00.

A series of five lectures on effects of surface stressing of metals on endurance under repeated loadings, presented during the National Metal Congress and Exposition, Cleveland, Oct. 4 to 8, 1946. The problem defined by H. F. Moore. Measurement of surface stresses, by W. M. Murray. Fatigue of metals as influenced by design and internal stresses, by J. O. Almen. Stressing axles and other railroad equipment by cold rolling, by O. J. Horger. Progressive stress-damage, by Peter R. Kosting.

27-148. Powder Metallurgy. Henry H. Hausner. 307 p. Chemical Publishing Co., Inc., 26 Court St., Dept. M. G. Brooklyn 2, N. Y. $7.00.

The principles of powder metallurgy. Methods of manufacture, commercially available metal powders, and their applications. The relationship between physical properties of the metal compact. A complete glossary of powder metallurgical terms and an annotated bibliography of 1064 references.

27-149. Manual of Foundry and Pattern Shop Practice. Otis J. Benedict, Jr. 361 p. McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y. $3.25.

The fundamental processes of pattern design and construction, molding, cupola operation, pouring, cleaning and inspection of castings. Pattern design and construction. A list of visual aids—motion pictures and film strips.

27-150. Mathematical Methods in Engineering. Theodore V. Karman. 505 p. McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y. $4.50.

This book should be of great use to the general designer. It requires only knowledge of algebra, analytical geometry, and basic calculus and, building upon them, clearly illustrates the methods of handling such problems as vibration, structures and dynamics. (From review in *Machine Design*, v. 19, July 1947, p. 155.)

27-151. Handbook of Structural Design in the Aluminum Alloys. J. E. Temple. 147 p. James Booth and Co., Ltd., Argyle Street Works, Nechells, Birmingham 7, England. 21s.

Written for engineers already experienced in the design of steel structures; stress is on differences between the use of aluminum alloys and steel.

THE "Materials Index", published monthly in conjunction with the Review of Current Literature, has been omitted from this issue. Readers who use this feature and find it valuable should so notify the publishers and it will be resumed. If you would like to have the Materials Index continued, please drop a note to *Metals Review*, 7301 Euclid Ave., Cleveland 3, O.

ew Jersey Presents Wyzalek Memorial Awards

Reported by Frank Kristufek
U. S. Steel Corp. Research Laboratory

The John F. Wyzalek Memorial wards, annually presented by the New Jersey Chapter ● to perpetuate the memory of the late John Wyzalek, were given to 14 students of seven Essex County vocational and technical high schools at the chapter meeting in May. The rewards are presented for original research reports of outstanding merit on the heat treatment of steel, and are designed to promote the training of men for the metal industries.

The presentations were made by past chapter chairman Willard L. Hults and the chairman of the Wyzalek Award Committee, W. C. Schulte of Curtiss-Wright Corp., Propeller Div.

EMPLOYMENT SERVICE BUREAU

The Employment Service Bureau is operated as a service to members of the American Society for Metals and no charge is made for advertising insertions. The "Positions Wanted" column, however, is restricted to members in good standing of the A.S.M. Ads are limited to 50 words and only one insertion of any one ad will be printed. Address answers care of A.S.M., 7301 Euclid Ave., Cleveland 3, Ohio, unless otherwise stated.

POSITIONS OPEN

East

MECHANICAL ENGINEER: Not over 35 yr., technical service on machining of alloys. Applicant should be familiar with shop practices of grinding, press work and spinning, and be capable of handling design, and solving of general mechanical engineering problems. Will be stationed in New York City with occasional traveling assignments and expenses paid. Training will be given for alloys manufactured by this company. In reply, give full academic and professional experience, recent photograph and salary expected. Box 8-5.

SPECTROGRAPH OPERATOR: To take complete charge of new spectrographic dept. just established in an eastern steel mill. Box 8-10.

FURNACE ERECTION SUPERINTENDENT: Exp. in all types of heat treating furnaces. Exp. men for estimating and designing furnaces and ovens. W. S. Rockwell Co., 200 Eliot Street, Fairfield, Conn.

RECENT COLLEGE GRADUATE: With training in physics, for work in research lab. of large manufacturer of alloy steels. Box 8-15.

RESEARCH METALLURGIST: With some exp. in alloy steels, to work in research lab. of large manufacturer of complete range of alloy steels. State age, marital status, education, exp. and salary expected. Box 8-20.

HEAT TREAT: Shop executive for planning and supervision of large heat treating plant handling great variety metals and parts. Philadelphia area. Must have good technical knowledge and broad practical experience. Excellent opportunity for advancement for really capable man. State qualifications fully and starting salary desired. Box 8-150.

TECHNICAL SALES: Metallurgist, chemical engineer, chemist. Free to travel. With training or experience in metal treating field. For contact work promoting specialized metallurgical processes using our product and for engineering equipment installation involved. Preliminary training period in Midwest, eventual location New England. In replying give education, exp., salary expected. Box 8-155.

Midwest

X-RAY: Research assistant, graduate physicist, physical metallurgist or physical chemist, for full-time work in the field of X-rays, crystal structure and related problems in physics of metals. Opportunity for tuition-free advanced study in night school. Give full qualifications and salary required in letter. Metals Research Laboratory, Carnegie Institute of Technology, Pittsburgh 13, Pa.

SALESMEN: For aluminum sales in various points of the country. Prefer men with a technical background or education, 2 to 5 yr. exp. in industrial sales, men with steel rolling mill background or steel sales exp. Training course for inexperienced men. Salaries appropriate to background. Box 8-25.

CHEMICAL ENGINEER: For work in Cleveland on research and development dealing with ceramic possibilities on precision manufactured products. Box 8-30.

METALLURGIST: A graduate engineer for work on welding problems with a large manufacturer of precision wearing parts—automotive and aircraft. Other lab. duties will be included. Box 8-35.

SERVICE ENGINEER: To sell and service cleaning chemicals to metal-working plants in Ohio territory. Salary and good commission to hard worker between 25 and 35 years. Car necessary. National organization manufacturing in Chicago with sales branch in Cleveland. Give complete details of qualifications, sales experience. Box 8-40.

SENIOR METALLURGIST: Ph.D. or equivalent, to organize and supervise research program in high temperature materials. **SENIOR PHYSICAL METALLURGIST:** Ph.D. or equivalent, for research in X-ray diffraction studies of materials at elevated temperatures. **NUCLEAR CHEMIST:** Ph.D. or equivalent, for nuclear and radiochemical studies. **SPECTROSCOPIST:** Ph.D. or equivalent, for research and management of spectrographic service laboratory within the research division. **CHEMIST AND METALLURGIST:** With knowledge of ceramics, to prepare reports and abstract current literature in the research division. Knowledge of German preferred but not essential. **PHYSICAL CHEMISTS AND PHYSICISTS:** Ph.D. or equivalent, for elevated temperature studies of materials. If interested in any of the above, please furnish resume giving personal, educational and experience data to N.E.P.A. Div., Fairchild Engine and Airplane Corp., P.O. Box 415, Oak Ridge, Tenn.

West

SALES REPRESENTATIVES: In Pittsburgh, in Texas, and West Coast districts for well-known line of custom-built industrial furnaces. Attractive straight commission basis. Box 8-45.

POSITIONS WANTED

CHIEF METALLURGIST: M.S. in met., 25 yr. exp. in making, fabricating and heat treating steel sheet, tin plate, bar, tubing and forgings. Metallurgical control of production, including various welding methods. Lab. supervisory exp. as well as customer and vendor contacts. Now employed but desires more responsibility with commensurate income. Cleveland district. Box 8-50.

METALLURGIST: B.S. in chem., 1934. Post-grad. study in met. Married, age 37. 1 yr. metals corrosion and electrochemistry. 4 yr. process engineer aircraft fabrication and metals refining, including supervision. 1½ yr. metallurgist engineering lab. Desires responsible position in met. or process engineering. Box 8-55.

METALLURGICAL ENGINEER: Ohio registered professional engineer. B.S. in met. eng., Case Institute of Technology. Age 26, married. Experience stainless and high alloy steels and stamping, fabrication and assembly. Extensive supervisory and research experience. Desires technical sales or contact work or engineering-management liaison. Location immaterial. Box 8-60.

METALLURGIST: Age 51. College grad. Exp. in the plating of automotive body and exterior hardware. 4 yr. in bronze fdry. Considerable exp. in sintered metals and in the production of powder for rapid sintering. Box 8-65.

PRECISION CASTING EXPERT: Exp., basic research, designing, purchasing, setting-up equipment and managing pilot and production lines for precision cast ferrous and nonferrous alloys, in investment and permanent molds, including working and technical knowledge of close tolerance plastic pattern molding. Desires permanent position with responsibility, advancement, and commensurate salary. Box 8-70.

CHEMICAL ENGINEER: 28, single. 1 yr. evaluation of metal cleaners and lacquers for aircraft. ½ yr. development work; 2½ yr. aluminum fdry. and machine shop testing and inspection. Veteran desires responsible position in engineering or production dept. of metal fabricating plant in the East. Box 8-75.

SALES REPRESENTATIVE: Grad. met. eng., office in Chicago, desirous of acquiring a line of precision castings or forgings. Box 8-80.

DIRECTOR OF RESEARCH: Desires change. Broad industrial exp. in product design and development, testing and research on materials, process research. Has applied time and motion study techniques on production operations. Marketing exp. includes advertising, promotion and sales. Published papers on fdry. practice, met. research, and management methods. Box 8-85.

METALLURGIST—CHEMICAL ENGINEER: Age 30, degree in chem. eng., 1940. Diversified industrial and teaching exp. 6 yr. exp. in nonferrous fdry. research and development. Now teaching at midwestern university. Training in production engineering, report writing and speaking. Suited for technical development and supervision. Box 8-90.

METALLURGIST: 5 yr. schooling; 11 yr. extensive shop and lab. exp. in field of heat treating, testing, inspection, machining and trouble investigation of steels. Competent metallographer. Desires responsible position in quality control, trouble investigation or research with progressive concern honestly endeavoring to improve metals and metal processes. Detroit area preferred. Box 8-95.

METALLURGIST: B.S., M.S. 4½ yr. alloy steel mill exp. in development, customer complaints, metallography, heat treatment, mill trouble shooting in openhearth and rolling mills. 7½ yr. in all phases of powdered metal fabrication including raw material control, development, tooling, customer contact, production supervision, both ferrous and nonferrous. Would prefer position leading to sales engineering or sales. Box 8-100.

MECHANICAL ENGINEER: Age 28, single. B.S. in mech. eng., machine design option. 9 mo. exp. on design of rolls for multipass die rolling and auxiliary equipment. 4½ yr. Army troop duty. Desires responsible work along a development line. Vicinity of Denver preferred, but elsewhere in U.S. acceptable. Box 8-105.

METALLURGIST: B. of met. eng., M.S. in met. Age 28, married. 3½ yr. exp. in aluminum and magnesium research and metal processing. Desires position as metallurgist or sales engineer in nonferrous met. Box 8-110.

CHIEF METALLURGIST OR ASSISTANT: Seeks executive contact with industry or educational institute. Grad. University of Vienna in mech. eng., Ph.D. from Polytechnic Academy of Brussels in phys. met. 10 yr. exp. ferrous and nonferrous as chief metallurgist and staff metallurgist with prominent automotive concern in lab., engineering, failure analysis, specification, ordnance. State registered. Commands technical German and French. Location immaterial. Box 8-115.

PLATING SUPERVISOR: Many yr. exp. in various phases of plating and finishing. Invented new solutions and polishing machines. Author of articles on plating, polishing, oxidizing and lacquering. Instructor, general foreman, consulting engineer, liaison engineer, trouble shooter. References on request. Available immediately, any location. Box 8-120.

METALLURGICAL ENGINEER: Age 29, married. B.S. from the University of Michigan. 4 yr. exp. quality control and material investigative work in aircraft engine plant, 1 yr. as only metallurgist in engineering divisions of prominent aircraft plant. Desires position involving product improvement or development, sales, or engineering instruction. Midwest or western N.Y. Box 8-125.

MECHANICAL ENGINEER: Age 28, married. B.M.E. degree, Cornell. Exp. in precision and heavy manufacturing. Knows machine tools, cost systems, business procedures. Interested in industrial future of Pacific Northwest. Box 8-130.

METALLURGICAL ENGINEER: Age 26, married. Graduating with B.S. in met. eng., University of Illinois, Oct. 1947. Honor student. 1 yr. exp. met. research lab, asst. 3½ yr. A.A.F. officer supervising 200 to 300 men. Desires position with future in development or production. Available Oct 15. Box 8-135.

METALLURGIST: B. met. eng. Age 30, married. Exp. as supervisor of heat treat and metallographic lab., ferrous and aluminum alloys. Familiar with all production heat treatment methods, including carburizing, induction hardening, flame hardening, atmosphere control. Extensive investigations of aluminum alloys. Desires to locate in South America in production position. Box 8-140.

STEEL FOUNDRY METALLURGIST: Met. Eng. 1939, M.S. 1947, minor in Industrial eng. Age 31, married. University instructor. Melting foreman basic and acid electric, and cupola-converter. Metallurgical basic and acid openhearth and Bessemer. Naval eng. officer. Originated new 5-min. acid slag analysis with control methods. Desires problem-solving position. Midwest preferred. Box 8-145.

Spectroscope Offers Accurate & Speedy Metal Analysis

Reported by Wylie J. Childs

Rensselaer Polytechnic Institute

Modern spectroscopic analysis offers the metallurgist a rapid yet accurate method of obtaining a multi-element quantitative determination of chemical composition. This point was emphasized in a talk on "Metallurgical Applications of Spectrographic Analysis" given by Dr. A. A. Burr of the Rensselaer Polytechnic Institute at a recent meeting of the Eastern New York Chapter.

Metals are particularly adapted to spectroscopic analysis for the following reasons: *(a)* They are good conductors and can therefore be easily excited by electrical means. *(b)* For most metals many persistent lines fall in the same region, which ranges from about 2000 to 4000 Angstrom units. *(c)* There is often in metallurgical work a definite need for an analysis of several elements when time is an important factor—a requirement well fulfilled in the spectrograph.

There are several disadvantages: *(a)* It is difficult to obtain an accurate determination of an element which exceeds 10% of the total composition. *(b)* Some metals have spectra that are either weak or are excited only with difficulty. *(c)* The addition of a second element may influence the intensity of the spectrum lines of the first element. It is possible, however, to make allowances for errors introduced in this way.

Excitation may be accomplished either by an arc or a spark between two pieces of the unknown or between the unknown and a piece of pure carbon. The d.c. arc is the most sensitive method, permitting readings down to one part per million, but it is somewhat unstable. An a.c. arc is more stable but some sensitivity is sacrificed. The third method of excitation—a condenser spark—is the most stable but at the same time the least sensitive.

The spectrograph is also useful for qualitative analysis, for preliminary work on unknowns and for identifying the various components of alloy compositions. It is a convenient check on chemical analysis and is helpful in trouble shooting to detect small traces of unsuspected additions.

It is possible to obtain an ordinary spectrographic analysis in 10 to 20 min. with an accuracy of about 3 to 5% of the quantity of element present. The modern trend has been to decrease this time for certain applications. Using a direct-reading spectrometer employing photo-electric cells, it is possible to analyze for as many as 11 elements in less than 2 min.

Earle Smith Awarded Sc.D. by Case Institute

E. C. Smith, chief metallurgist Republic Steel Corp., was awarded degree of doctor of science by Case stitute of Tech ogy, Cleveland, awarding the gree, Dr. William Wickenden, retir president of Ca hailed Smith as "i ternationally claimed as ma of the art and ponent *par exc lence* of the scie of steelmaking, zealous compan in the search knowledge and a zealous worker the advancement of professional Dr. Smith has been with Republic its predecessor companies since Wo War I. He was presented the Go Medal of the American Society Metals in 1946.

E. C. Smith

Cook Is New Kloster President

James B. Cook has recently be appointed president and general ma ager of Kloster Steel Corp., Chica He has been associated with the co poration for the past 18 years as meta lurgical engineer and in charge of sa

READER SERVICE COUPON

CHECK THESE NUMBERS FOR PRODUCTION INFORMATION AND MANUFACTURERS' CATALOGS

Use this convenient method to obtain further information on items of interest to you in METAL REVIEW. The following numbers refer to the new products and manufacturers' literature in this issu

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Metals Review, August 1947

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Six Fundamental Developments Sired Modern Metallurgical Advances

Reported by Frank Kristufek

U. S. Steel Corp. Research Laboratory

Virtually all of the many practical advances of modern metallurgy have been sired by six outstanding developments of a fundamental nature, according to Fred P. Peters, editor-in-chief of *Materials and Methods*, who spoke at the May meeting of the New Jersey Chapter. These six developments are:

1. New knowledge of the transformations in, and hardenability of, steel.
2. Successful study and increasing understanding of precipitation-hardening phenomena in nonferrous alloys.
3. Definition of the mechanism of failure under repeated stresses.
4. The "science" of mass production of precision parts.
5. Clarification of flow phenomena in metals as related to atomic structures or lattices.
6. Discovery of the disproportionately great effects of tiny amounts of impurities, especially gases, in metals.

However, even today we are not making all the use we could of the scientific knowledge that is available, stated Mr. Peters. For instance, we are still unable to correlate design, material, and fabrication method with the expected stress concentration, temperature, and rate of loading to be experienced by the finished product in actual service. One big opportunity for heat treating progress still largely unexplored is the application of the principles of heat transfer to the heat treatment of steel to improve quenching practice.

As a nation, we should apply recently developed scientific geophysical methods to the location and ultimate working of subsurface ore deposits. Unless new deposits not now known are unearthed, stated the speaker, the known high-grade ore reserves of our most important commercial metals may be exhausted within 50 years, and a complete realignment of the important commercial metals may occur. Already aluminum is seriously challenging copper on an economic basis for the electrical market.

More common sense will be mixed in with our fundamental science, according to Mr. Peters. Simulated service testing will replace misleading or meaningless arbitrary standardized test methods for many purposes.

In the fields where new scientific knowledge is needed, the metallurgical and materials engineering aspect of atomic fission, the development of high-temperature alloys that can continuously withstand temperatures hundreds of degrees higher than the present 1500 to 1600° F. range, the discovery or design of superstrength metallic materials, the implications of superconductivity and the likelihood of metals like titanium and beryllium emerging as commercially important base metals—all are bright spots in the picture of our future science of metals.

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